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IN THE

Supreme Court of the United States

OCTOBER TERM, 1994

GENERAL ELECTRIC COMPANY, *et al.*,
Petitioners,

v.

PATRICIA INGRAM, *et al.*,
Respondents.

Petition for a Writ of Certiorari to the United States Court of Appeals for the Third Circuit

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APPENDIX TO PETITION FOR A WRIT OF CERTIORARI

(PART I—OPINION OF COURT OF APPEALS)

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APPENDIX I

Filed August 31, 1994

UNITED STATES COURT OF APPEALS
FOR THE THIRD CIRCUIT

No. 92-1995

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MABEL BROWN, Individually and on
behalf of all others similarly situated

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION
AUTHORITY ("SEPTA"); NATIONAL RAILROAD
PASSENGER CORPORATION ("AMTRAK"); AND
CONSOLIDATED RAIL CORPORATION
("CONRAIL")

v.

UNITED STATES OF AMERICA;
ROY F. WESTON, INC.; and
OH MATERIALS COMPANY; and
GENERAL ELECTRIC COMPANY; and
THE BUDD COMPANY; and
WESTINGHOUSE ELECTRIC CORPORATION;
MONSANTO CO.;
PENN CENTRAL CORPORATION
Mabel Brown, Appellant

(D.C. Civ. No. 86-02229)

No. 92-1997

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

WALLACE DARRYL CUMMINS

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA"); and
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION, ("CONRAIL")

v.

UNITED STATES OF AMERICA; and
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
MONSANTO COMPANY
Wallace D. Cummins, Appellant

(D.C. Civ. No. 86-02669)

No. 92-1999

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

K. LOUISE JONES, ADMINISTRATRIX OF THE ESTATE OF HARVEY N. JONES, JR., DECEASED AND
K. LOUISE JONES AS PERSONAL REPRESENTATIVE OF HARVEY N. JONES, JR., AND K. LOUISE JONES IN HER OWN RIGHT

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK")
CONSOLIDATED RAIL CORPORATION, ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
MONSANTO COMPANY;
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY; AND
WESTINGHOUSE ELECTRIC CORPORATION
K. Louise Jones and
Harvey Jones, Appellants

(D.C. Civ. No. 86-05277)

No. 92-2000

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

JAMES LAMENT, individually and on behalf of all others similarly situated

v.

SEPTA; AMTRAK and CONRAIL;

v.

PENN CENTRAL CORPORATION;
UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
MONSANTO CO.;
GENERAL ELECTRIC CO.;
BUDD CO., AND
WESTINGHOUSE ELECTRIC CORPORATION
James Lament, Appellant

(D.C. Civ. No. 86-05886)

No. 92-2001

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

CHRISTOPHER S. BROWN;
JACQUELINE M. BROWN, h/w

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION;
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

PENN CENTRAL CORPORATION;
UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION

Christopher Brown and Jacqueline Michelle Brown, Appellants

(D.C. Civ. No. 86-07414)

No. 92-2002

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

CATHLENE BROWN,

Appellant

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK");
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION

v.

PENN CENTRAL CORPORATION

(D.C. Civ. No. 86-07415)

No. 92-2003

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

CRAIG A. BROWN AND
CATHERINE D. BROWN h/w

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
PENN CENTRAL CORPORATION; AND
CITY OF PHILADELPHIA;
GENERAL ELECTRIC CO.;
THE BUDD CO.; AND
WESTINGHOUSE ELECTRIC CORP.
Craig Brown, Appellant

(D.C. Civ. No. 86-07416)

No. 92-2004

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MARGHERITA BARBETTA,
Appellant

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION
AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION
("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA; and
CITY OF PHILADELPHIA;
THE GENERAL ELECTRIC COMPANY; AND
THE BUDD COMPANY; AND
WESTINGHOUSE ELECTRIC CORPORATION

v.

PENN CENTRAL CORPORATION

(D.C. Civ. No. 86-07417)

No. 92-2005

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MARY RETTA JOHNSON,
Appellant

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA; and
THE CITY OF PHILADELPHIA; and
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY; and
WESTINGHOUSE ELECTRIC CORPORATION; and
PENN CENTRAL CORP.

(D.C. Civ. No. 86-07418)

No. 92-2006

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

CELESTE BROWN,
Appellant

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA; and
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION

(D.C. Civ. No. 86-07419)

No. 92-2007

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

CLEMMON L. BROWN

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA; AND
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY; AND
WESTINGHOUSE ELECTRIC CORPORATION; AND
PENN CENTRAL CORPORATION
Clemmon Brown, Appellant

(D.C. Civ. No. 86-07420)

No. 92-2008

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

CLOYD H. BROWN

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION
AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION
(" AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION
Cloyd Brown, Appellant

(D.C. Civ. No. 86-07421)

No. 92-2009

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

CURTIS BROWN,

Appellant

v.

MONSANTO COMPANY;
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION (" AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA

v.

GENERAL ELECTRIC COMPANY; and
THE BUDD COMPANY; and
WESTINGHOUSE ELECTRIC COMPANY;
PENN CENTRAL CORP.

(D.C. Civ. No. 86-07422)

No. 92-2010

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

JOHN INGRAM, SR., and
PATRICIA INGRAM, in their own right and as parents and natural guardians of JOHN INGRAM, JR.; and APRIL INGRAM in her own right

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION (" AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL"); and
MONSANTO COMPANY ("MONSANTO"); and
GENERAL ELECTRIC COMPANY ("GE"); and
CITY OF PHILADELPHIA ("PHILADELPHIA")

v.

UNITED STATES OF AMERICA;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION
John Ingram, Sr. (and as representative of decedent Patricia Ingram), John Ingram, Jr., Patricia Ingram and April Ingram Robinson-Ray, Appellants

(D.C. Civ. No. 86-07561)

No. 92-2011

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MARY ALICE KNIGHT,
Appellant

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL"); and
MONSANTO COMPANY ("MONSANTO"); and
GENERAL ELECTRIC COMPANY ("GE"); and
CITY OF PHILADELPHIA ("PHILADELPHIA")

v.

UNITED STATES OF AMERICA;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION

(D.C. Civ. No. 87-00712)

No. 92-2014

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

WILLIAM BUTLER; THERESA BUTLER;
MARVIN L. SIMPSON; ALLEN K. SIMPSON;
KAREN R. SIMPSON; DONALD E. SIMPSON; and
BRYAN M. JACKSON

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION
AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION
("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
MONSANTO COMPANY;
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION
William Butler, Theresa Butler,
Bryan Jackson, Allen Simpson,
Donald Simpson, Karen Simpson,
and Marvin Simpson, Appellants

(D.C. Civ. No. 87-02874)

No. 92-2016

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MATTHEW CUNNINGHAM; and
BESSIE CUNNINGHAM,
Appellants

v.

MONSANTO COMPANY; and
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION,
Third-Party Defendants

(D.C. Civ. No. 87-05269)

On Appeal From the United States District Court
For the Eastern District of Pennsylvania

Argued: October 26, 1993

Before: BECKER, ROTH, and LEWIS, *Circuit Judges.*

(Filed August 31, 1994)

[As Amended October 17, 1994]

OPINION OF THE COURT

BECKER, *Circuit Judge.*

I. INTRODUCTION

The plaintiffs in this toxic tort case have lived for many years in the vicinity of the Paoli Railyard, a railcar maintetenance facility at which polychlorinated biphenyls (PCBs) were used in profusion for over a quarter century. They have sued to recover damages for a variety of physical ailments and for property damage against the corporations that have maintained the railyard and that sold the PCBs.

This appeal is from the district court's second grant of summary judgment for the defendants. In *In re Paoli Railroad Yard PCB Litigation*, 916 F.2d 829 (3d Cir. 1990) ("*Paoli I*"), *cert. denied*, 499 U.S. 961, 111 S. Ct. 1584 (1991), we reversed the grant of summary judgment for defendants and remanded for further proceedings. We did so because the foundation of the summary judgment—the exclusion of virtually all the plaintiffs' expert opinion pursuant to Federal Rules of Evidence 702, 703 and 403—was undermined by (1) the failure of the district court to permit sufficient development of the record upon which a determination to exclude expert evidence might be based, and (2) the district court's failure to make findings, grounded on Fed. R. Evid. 702 or 703, setting forth the basis of its decision.

On remand the district court conducted five days of *in limine* hearings, receiving extensive evidence about the scientific reliability of plaintiffs' expert opinions. It then filed extensive opinions (totalling 330 pages) setting forth not only findings of fact but also its reasons for again excluding the vast bulk of plaintiffs' expert evidence. This appeal followed.

Resolution of the appeal requires that we address myriad issues of procedure, evidence, and substantive law. Primarily, however, we must consider the voluminous record concerning expert opinion and, applying Fed. R. Evid. 702 and the standards enunciated by the Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 113 S. Ct. 2786 (1993), decide whether the district court erred in again excluding the opinions of plaintiffs' experts in connection with its summary judgment determination. *Daubert* requires the district court to act as "gatekeeper" and to assure that the scientific methodology upon which the expert opinion is founded is reliable, i.e., that the expert's conclusion is based on good grounds (the methods and principles of science). We also must deal with Fed. R. Evid. 703 because the district court's exclusion of expert testimony rests, in part, on its conclusion that some of the hearsay evidence upon which the experts relied is not of a kind usually relied on by experts in the field. In this regard we conclude that the precept announced in *In Re: Japanese Electronics Products Antitrust Litigation*, 723 F.2d 238 (3d Cir. 1983), *rev'd on other grounds sub nom., Matsushita Electrical Industrial Co. v. Zenith Radio Corp.*, 475 U.S. 574, 106 S. Ct. 1348 (1986), that the principal arbiters of the reasonableness of reliance upon inadmissible evidence are the experts and not the trial judge, does not survive *Daubert*.

Preliminary to an application of Rules 702-703 to the evidentiary rulings at issue, we must address the question of the proper scope of review. Although review of the district court's fact findings that undergird its rulings on the admissibility of expert opinion is deferential, given the enormous power of the district court to foreclose submission of a party's case to a jury on the basis of a threshold determination of nonreliability of opinion evidence, we conclude that the review requires a "hard look" to insure that the district court's exercise of discretion was sound and that it correctly applied the several *Daubert* factors. Then to the extent that any of the expert opinion survives,

we must determine whether the plaintiffs can avoid summary judgment on any of the claims to which the surviving opinion pertains.

For the most part we affirm the rulings and the judgment of the district court. However, we also reverse in part, and remand some claims for trial. In summary we rule as follows.

1. We affirm the district court's decision to retain jurisdiction in this case based on pendent jurisdiction stemming from the plaintiffs' prior CERCLA claims.

2. We affirm the district court's discretionary ruling allowing certain of defendants' experts to testify at the *in limine* hearings without being deposed; however, we point out that depositions should generally be afforded in future cases of this nature. We do not reach the propriety of its decision excluding plaintiffs' experts for whom no Rule 26(b)(4) statements were filed because plaintiffs do not rely on these experts in opposition to summary judgment.

3. We reverse the district court's exclusion of the opinion of Dr. Janette D. Sherman insofar as it was grounded on the conclusion that she was an unqualified expert. However, we affirm the district court's holding that she could not rely on immunological tests from an unaccredited laboratory. We also affirm the district court's exclusion of the opinions of Dr. Sherman as to causation of plaintiffs' present injuries with respect to those plaintiffs whom she did not examine and whose medical history she did not take. We believe that, in the absence of employment of the standard techniques of differential diagnosis, and in the absence of any good explanation justifying her conclusion in the light of possible alternative causes of plaintiffs' injuries, Dr. Sherman's methodology as to those plaintiffs was not reliable, as the district court found.

4. We affirm the district court's exclusion of the opinion of Dr. G. John DiGregorio with respect to causation of the injuries of those plaintiffs for whom he testified.

Because Dr. DiGregorio neither examined these plaintiffs nor took their medical histories, he did not have a reliable basis from which to conclude they were ill. Moreover, as with Dr. Sherman, in the absence of employment of standard techniques of different diagnosis, and failure to provide any explanation as to why he concluded that PCBs rather than alternative possibilities had caused plaintiffs' illnesses, we conclude that Dr. DiGregorio's assessment of causation was unreliable.

5. We reverse the district court's exclusion from evidence of the opinions of Dr. Sherman with respect to most of the injuries of Bessie Cunningham and Amber Burrell, whom she actually examined and whose medical histories she took. In light of: (1) Dr. Sherman's employment of the standard techniques of differential diagnosis with respect to those plaintiffs, and (2) defendants' failure to point to possible alternative causes of their injuries which Dr. Sherman failed to consider, we are satisfied that, with respect to them, Dr. Sherman's scientific methodology was reliable and that the district court's exclusion of her opinion represented an impermissible jury-like determination that it preferred the defendants' experts' opinion to that of Dr. Sherman.

6. We affirm the district court's exclusion from evidence of the opinion of Dr. Ian Nisbet regarding plaintiffs' exposure to PCBs: (1) insofar as that opinion is based on a recalculation of American Medical Laboratory test ("AML") results to account for the degree to which the laboratory ostensibly underestimated its results; and (2) insofar as it is grounded on "back calculations" of plaintiffs' PCB blood levels in 1986 based upon the results of studies made by the Eco Logic laboratory in 1992. We conclude that Dr. Nisbet's methodology in recalculating the AML tests was unreliable, and that the Eco Logic data from which he began his back calculations was not a type reasonably relied on by experts in the field due to the quality control problems in Eco Logis's methodology.

7. We reverse the district court's exclusion of the remainder of Dr. Nisbet's opinion, including his conclusion that plaintiffs had PCBs in their blood at levels above the background PCB levels in the general population. We are satisfied that Dr. Nisbet's calculation of background blood levels from National Human Adipose Tissue Survey ("NHATS") fat data was based on a reliable methodology, and that the NHATS data was a type of data reasonably relied on by experts.

8. We reverse the district court's exclusion of animal studies. Where, as here, these studies were supported by some epidemiological data and had been used by EPA to conclude that PCBs were a probable human carcinogen, plaintiffs' experts had good grounds for determining that they "fit" a conclusion regarding human causation.

9. We affirm the district court's exclusion of data on chemicals other than PCBs and its exclusion of testimony related to the incidents at Yusho (in Japan) and Yu Cheng (in Taiwan). The district court's conclusion under Fed. R. Evid. 403 that the probative value of this evidence would have been substantially outweighed by unfair prejudice (and would have resulted in significant waste of trial time for resolution of collateral issues) was based on a more than adequate record (one justifying the rare making of the pretrial ruling based on Rule 403), and on findings of fact which, under the applicable standard of review we cannot disturb.

10. We reverse the grant of summary judgment with respect to those personal injury plaintiffs for whom Dr. Sherman's testimony is admissible, concluding that they have demonstrated the existence of a genuine issue of material fact as to whether defendants exposed them to PCBs which caused their present injuries.

11. We reverse the grant of summary judgment with respect to the medical monitoring claims. Although recent changes in Pennsylvania law have interred plaintiffs' increased risk claims, we still believe that the Pennsylvania

Supreme Court would recognize the plaintiffs' medical monitoring claims, and are satisfied that Dr. Sherman's testimony as to the plaintiffs' future risk is sufficient to get them over the summary judgment threshold.

12. We reverse the grant of summary judgment on plaintiffs' claim with respect to diminution in property value. Based on an extrapolation from existing Pennsylvania case law, we predict that where (1) the defendants have caused some physical harm to plaintiffs' property; (2) repair of this damage will not restore the value of the property to its prior level; and (3) there is at least some ongoing risk to the plaintiffs' land, Pennsylvania would allow plaintiffs to recover damages for the diminution of their property value. On the present record, there remains a genuine issue of material fact on the permanency of damage issue.

13. With respect to all other claims, which represent the bulk of plaintiffs' case, the exclusion of expert opinion leaves the plaintiffs with inadequate evidence to survive summary judgment. We will therefore affirm the grant of summary judgment on these remaining claims.

II. FACTS AND PROCEDURAL HISTORY

Beginning in the 1950s, if not before, PCBs were used at the Paoli Railroad Yard (the "Yard") as a fire-resistant insulating fluid in railroad car transformers. PCBs gradually accumulated in the Yard and leaked off the Yard into groundwater and ultimately into the soil of nearby residences. (A1122-1123). Several studies from 1979-1986 documented high levels of PCBs in the Yard and in nearby water and land. The National Institute for Occupational Safety and Health (NIOSH) identifies the site as containing the worst PCB contamination it has ever encountered during a health inspection.

In 1986, the United States sued SEPTA, Conrail and Amtrak under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 42 U.S.C.

§ 9601, to compel the cleanup of the Yard. After the entry of five consent decrees, which primarily required the control of leakage from the Yard, EPA adopted a final plan, the Record of Decision, in July of 1992. This plan requires extensive excavation and treatment of soils both at the Yard and on nearly residential property and streams, and erosion controls at the Yard.

The palintiffs in this action consist of individuals who lived near the Yard in areas identified by EPA and by the railroad defendants' contractor, Groundwater Technologies, Inc., as having experienced the most severe run-off from the Yard. The plaintiffs have adduced evidence of significant levels of PCBs in the soil at their homes. Many of the plaintiffs played in the soil at their homes while growing up, gardened in it, and ate vegetables grown from it. Many also regularly traversed the Yard on foot as a short cut to their destinations.

In 1986, thirty eight plaintiffs brought suit in the District Court for the Eastern District of Pennsylvania. Some sought recovery for present injuries, (allegedly caused by exposure to PCBs and other assorted chemicals from the Yard, including polychlorinated dibenzo furans ("furans") and polychlorinated dibenzo-p-dioxins ("dioxins")). Some plaintiffs, many of whom have not yet suffered any physical injury, brought claims for emotional distress caused by fear of future injury, and for medical monitoring to decrease the likelihood of the future development of serious diseases. Finally, some of the plaintiffs have brought claims for the decrease in value to their property caused by the presence of PCBs on the land.

The defendants (in some or all of the cases) are Monsanto Corporation, the nation's leading manufacturer of PCBs; General Electric Company, manufacturer of some of the railroad car transformers in which the PCBs were used; Amtrak, owner of the Yard since 1976; Conrail, which operated the facility between 1976 and 1983; the Southeastern Pennsylvania Transit Authority

(SEPTA), which has operated the facility since 1983; and the City of Philadelphia, which is linked with SEPTA. SEPTA filed third-party complaints against Westinghouse Electric Corporation, manufacturer of some of the transformers used at the Yard, and the Budd Company manufacturer of some of the railroad cars. Conrail filed a third part complaint against the Penn Central Corporation.

In November of 1988 the district court granted defendants' motion for summary judgment against all plaintiffs on the personal injury claims because it held that all of plaintiffs' evidence pertaining to significant exposure and causation, necessary elements of their claims, was inadmissible. The court excluded the evidence under Federal Rule of Evidence 702, which requires expert witnesses to be qualified and to use reliable scientific techniques, Rule 703 which requires experts to rely on data of a type reasonably relied upon by experts in the field, and Rule 403 which requires the probative value of evidence not to be substantially outweighed by unfair prejudice or undue delay. *See In re Paoli Railroad Yard PCB Litigation*, 706 F.Supp. 358 (E.D. Pa. 1988).

In *Paoli I*, 916 F.2d at 854, this Court reversed the Rule 703 holdings because the district court had not created a sufficiently detailed factual record on which to base them and had not given "the plaintiffs sufficient opportunity to explore the issues upon which they were ultimately denied relief." We reversed the district court's Rule 702 holdings because it had construed the qualification requirement of Rule 702 too strictly, *see id.* 855-56, and because it had not created a detailed enough factual record to justify exclusion of the experts' opinion under the reliability prong of Rule 702. *See id.* at 858-59. Finally, we reversed the district court's Rule 403 determinations, holding that Rule 403 exclusions should not be granted pre-trial absent a record which is "a virtual surrogate for a trial record." *Id.* at 859-60. We strongly suggested that the district court should have held an *in*

limine hearing before excluding plaintiffs' expert opinion. *Id.* at 859.

Following remand, the district court issued a case management order in June 1991, giving plaintiffs until March 2, 1992 to complete their discovery, and until March 17, 1992 to designate their trial experts and provide defendants with their experts' reports. The court required the defendants to do likewise one month after plaintiffs.

The list of expert witnesses designated by the plaintiffs in March of 1992 was considerably different from the list at the time of the 1988 summary judgment. The twenty-three plaintiffs represented by the Kohn, Nast, & Graf, and Klehr, Harrison, Harvey, Branzburg, Ellers, & Weir law firms (the "Kohn/Klehr" plaintiffs) named three experts supporting their personal injury claims: Melvyn Kopstein, Ph.D., to testify about the Paoli residents' opportunities for exposure to PCBs from the Yard; Ian C.T. Nisbet, Ph.D., to testify about the plaintiffs' exposure to PCBs; and Janette Sherman, M.D., to testify that PCBs had caused plaintiffs' injuries and that plaintiffs require medical monitoring to detect and treat future PCB-related illnesses.

Defendants moved *in limine* to exclude the opinions of each of these experts under Fed. R. Evid. 702, 703 and 403. On the same grounds, defendants filed motions *in limine* to preclude the plaintiffs' experts from testifying about animal studies purporting to show the harmful effects tof PCBs, evidence concerning the harm of dioxins and furans (chemicals that are sometimes present in transformer fluids), and evidence concerning the "Yusho" incident in Japan and the "Yu Cheng" incident in Taiwan in which many individuals suffered adverse effects after consuming rice oil contaminated with PCBs and furans.

Bruce Hanes, who represented the nine remaining plaintiffs (the "Hanes plaintiffs"), designated Dr. G. John DiGregorio, M.D. to testify that PCBs had caused their

injuries, and Arnold Schechter, M.D., M.P.H., to testify that their fear of future illness was reasonable. In joint pretrial memorandum filed on July 17, 1992, the Kohn/Klehr and Hanes plaintiffs designated three additional trial experts— Deborah Barsotti, Ph.D., Benjamin Calesnick, M.D., and Arthur Zahalsky, Ph.D.—who had offered opinions for the plaintiffs in 1988. They also listed William J. Nicholson, Ph.D. and Cate Jenkins, Ph.D. as fact witnesses. Defendants moved to exclude these witnesses because plaintiffs had failed to designate them as experts in March, as the district court's pre-trial order had required.

The district court held five days of *in limine* hearings between July 28 and August 7, 1992. Drs. Kopstein, Nisbet, and Sherman testified for the plaintiffs. Ten physicians and scientists testified for the defense. On October 21, 1992, the court entered orders excluding all but one of plaintiffs' experts (Dr. Kopstein). The court also excluded evidence concerning animal studies, dioxins and furans, and the incidents at Yusho and Yu Cheng. The court then granted summary judgment against the plaintiffs on their personal injury claims.

The court explained that under our holding in *Paoli I*, the plaintiffs had to establish the following elements to make out a prima facie case: (1) that the defendants had released PCBs into the environment; (2) that the plaintiffs had somehow ingested those PCBs into their bodies; (3) that the plaintiffs have an injury; and (4) that PCBs are the cause of their injury. *See Paoli I*, 916 F.2d at 860. Not surprisingly, after excluding plaintiffs' experts, the court found that plaintiffs had no evidence on either exposure or causation and thus could not prove elements 2, 3, and 4. For similar reasons, the court granted summary judgment against the plaintiffs on their medical monitoring claims.

Nine plaintiffs—Mabel Brown, K. Louise Jones, James Lament, Christopher Brown, Margherita Barbetta, Mary Retta Johnson, John Ingram, William Butler, and Matthew Cunningham—also brought property damage claims against the defendants. The district court granted summary judgment in favor of the defendants on these claims as well. The court held that Pennsylvania law only allows recovery for diminution of a property's market value if there has been permanent damage to the property; and the court found that plaintiffs could not prove such permanent damage in light of EPA's proposed cleanup plan.

The plaintiffs challenge the district court's subject matter jurisdiction, all of its admissibility decisions, its legal conclusions regarding diminution of a property's market value, and the court's grant of summary judgment. We will affirm most of the district court's decisions. We reverse only its grant of summary judgment on a number of the present injury claims of Bessie Cunningham and Amber Burrell, and its grant of summary judgment on the plaintiffs' claims for medical monitoring and diminution in property value.

III. SUBJECT MATTER JURISDICTION OF THE DISTRICT COURT [1]

Plaintiffs' original claims in 1986 included a CERCLA claim, 42 U.S.C. § 9600 *et seq.*, which conferred federal question jurisdiction, 28 U.S.C. § 1331(a), on the district court. The court possessed pendent jurisdiction over plaintiffs' other claims. However, plaintiffs voluntarily dismissed the CERCLA claim after our ruling in *Paoli I*. Plaintiffs contend that, after this dismissal, the district court no longer had subject matter jurisdiction over the case because, absent the CERCLA claim, there was no

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[1] Appellate jurisdiction is predicated on 28 U.S.C. § 1291.

federal question jurisdiction; nor was there complete diversity.[2]

In *United Mine Workers v. Gibbs*, 383 U.S. 715, 86 S. Ct. 1130 (1966), the Supreme Court held that in evaluating whether to exercise pendent jurisdiction, a district court must weigh "considerations of judicial economy, convenience and fairness to [the] litigants," 383 U.S. at 726, 86 S. Ct. at 1139.[3] In holding that these factors favored retention of jurisdiction here, the district court acted within the ambit of its discretion.

Considerations of judicial economy clearly weighed in favor of the district court retaining jurisdiction. Although considerations of judicial economy alone are generally insufficient to justify a district court's decision to retain

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[2] In 1990 Congress enacted 28 U.S.C. § 1367 which codifies principles governing pendent jurisdiction for civil actions commenced after December 1, 1990. However, that statute does not apply to this case, which was filed in 1986.

[3] Plaintiffs rightly note that, except under extraordinary circumstances, these considerations militate against a district court retaining pendent jurisdiction when there are no longer any federal claims. *See Shaffer v. Board of Sch. Directors*, 730 F.2d 910, 913 (3d Cir. 1984). Nonetheless, this is a discretionary decision for the district court. Although in *Gibbs*, the Supreme Court stated that, "[n]eedless decisions of state law should be avoided . . . Certainly, if the federal claims are dismissed before trial, even though not insubstantial in a jurisdictional sense, the state claims should be dismissed as well," 383 U.S. at 726, 86 S. Ct. at 1139, we have explained that:

> [t]his sentence appeared . . . in the context of a discussion of [the] discretionary nature of pendent jurisdiction. Moreover, in *Rosado* [*v. Wyman*], 397 U.S. 397[, 403], 90 S. Ct. 1207[, 1213-14] (1969), the Court upheld an exercise of pendent jurisdiction despite the pretrial dismissal of the underlying claim and in so doing confirmed that an early dismissal of a federal claim would not deprive a court of constitutional power to hear a pendent claim.

Lentino v. Fringe Employee Plans, Inc., 611 F.2d 474, 479 n. 4 (3d Cir. 1979).

jurisdiction, *see Shaffer v. Board of Sch. Directors,* 730 F.2d 910, 912 (3d Cir. 1984); *Lovell Mfg. v. Export-Import Bank of U.S.,* 843 F.2d 725, 734-35 (3d Cir. 1988), we have held such concerns sufficient when they are especially strong. In *Lentino v. Fringe Employee Plans, Inc.,* 611 F.2d 474, 480 (3d Cir. 1979), we upheld a district court's decision to retain jurisdiction over a state law claim when plaintiffs dropped their federal claims on the morning of trial after there had already been a year of pretrial proceedings.

The concerns of judicial economy here are at least as strong as they were in *Lentino.* Although the plaintiffs dropped their CERCLA claim much earlier than the morning before trial, far more energy had been invested in the proceedings here than in *Lentino.* Six years of federal proceedings had occurred before the plaintiffs dropped their CERCLA claim, including extensive discovery. Moreover, the concern over judicial economy was combined here with two other factors strongly militating in favor of retention of jurisdiction.

First, the district court would have continued to have jurisdiction over plaintiffs' claims against Amtrak, *see* 28 U.S.C. § 1349 (providing district court jurisdiction over all corporations incorporated by an act of Congress in which the United States owns more than half the stock) even if it had dismissed most of plaintiffs' claims for lack of jurisdiction. Amtrak doubtless would then have impleaded the other defendants, all of whom had deep pockets, thus changing the alignment of the parties but not the nature of the litigation. In such circumstances, a district court acts within its discretion in retaining jurisdiction. *Cf. New Jersey Dept. of Envtl. Prot. v. Gloucester Envtl. Mgmt. Services, Inc.,* 719 F.Supp. 325, 337 (D.N.J. 1989), retaining jurisdiction in order to prevent "a litigation merry-go-round").

Second, plaintiffs were the ones who initially filed their claims in federal court and obtained a 1986 ruling that

the CERCLA claims created federal jurisdiction. Plaintiffs dismissed their CERCLA claims and argued against federal jurisdiction only after the district court had first granted summary judgment against them. Thus, plaintiffs' dismissal of their CERCLA claims may well constitute an attempt to forum shop by divesting the district court of jurisdiction. In *Carnegie-Mellon Univ. v. Cohill*, 484 U.S. 343, 108 S. Ct. 614 (1988), the Supreme Court held that the possibility of forum shopping is one factor a district court should take into account in exercising its discretion with respect to pendent jurisdiction. *See id.* at 351, 356, 357 & n.12, 108 S. Ct. at 619, 622-23 & n.12.

Cohill, to be sure, was not about whether a district court should retain jurisdiction, but rather about what a district court should do after deciding not to retain jurisdiction, i.e. whether the court should dismiss the case, which might end it due to statute of limitations problems in state courts, or whether the court should remand the case to the state court from whence it had been removed. But *Cohill* did hold that one factor the district court should consider in deciding whether to remand the case to state courts is whether plaintiffs are attempting to forum shop. We hold that the same principle applies when the district court decides whether to retain jurisdiction in the first place.

In sum, fairness to defendants along with judicial economy and convenience justify the district court's decision to retain jurisdiction here.

IV. WAS THE *IN LIMINE* HEARING TAINTED BY UNFAIR PROCEDURES?

Before addressing the central issues in the case (regarding the admissibility of the opinions of the plaintiffs' experts under Rules 702, 703 and 403), we must dispose of some preliminary questions. The plaintiffs contend that the district court should not have relied on the testimony of the defendants' experts in excluding the tes-

timony of the plaintiffs' experts, because the defendants failed to designate these experts in accord with the time schedule announced by the district court. We review for abuse of discretion, and find none with respect to this ruling.

Plaintiffs also submit that the district court should not have relied on its scheduling order to exclude the testimony of some of plaintiffs' proposed experts. We do not have to reach the merits of this contention, because plaintiffs did not point to the testimony of these experts in opposition to summary judgment.

A. *Inadequate Opportunity to Depose Defense Experts*

On June 4, 1991, the district court issued an order requiring defendants to "designate all *trial* expert witnesses" by April 17, 1992 and giving the parties "until June 17, 1992 to depose expert witnesses." (emphasis added). On June 25, 1992, well after the deadline the district court had set for identification of experts, defendants submitted affidavits from a new set of experts. Defendants intended to have these experts testify at the August *in limine* hearing but not at trial. Because discovery was closed, plaintiffs were unable to depose them.

Plaintiffs moved to prevent these experts from testifying. The district court never ruled on this motion, allowed the experts to testify at the *in limine* hearing, and relied on their testimony in excluding much of plaintiffs' evidence. Plaintiffs contend that this was error. On a purely formal level, we disagree for, as defendants correctly assert, the district court's June 1991 order setting deadlines for the identification of experts was only directed at *trial* witnesses and said nothing about witnesses who were to testify only at the *in limine* hearing. But that conclusion does not settle the question. By coincidence, plaintiffs' more significant claim of error is encapsulated in a recent law review article by Professor Berger,

who argues that "[c]ourts should not permit the defendant to obtain a hearing on a motion in limine by relying on affidavits from experts unless their identity and reports have been supplied to the plaintiff in the course of discovery and the plaintiff had an opportunity to depose [them]" Margaret A. Berger, *Procedural Paradigms for Applying the* Daubert *Test*, 78 Minn. L. Rev. 1345, 1372 (1994).

The district court certainly had the power to provide that the experts who were to testify at the *in limine* hearing be subject to discovery. *See* Berger, *supra*, at 1372 n.141. ("A court undoubtedly has power pursuant to Federal Rule of Civil Procedure 16 to require parties to provide each other with expert reports and an opportunity for the deposition of experts retained in connection with in limine motions."). And we generally agree with Professor Berger that because under *Daubert* a judge at an *in limine* hearing must make findings of fact on the reliability of complicated scientific methodologies and this fact-finding can decide the case, it is important that each side have an opportunity to depose the other side's experts in order to develop strong critiques and defenses of their expert's methodologies. *See Paoli I*, 916 F.2d at 854 ("[T]he detailed factual record requirement, firmly entrenched in our jurisprudence, requires adequate process at the evidentiary stage, particularly when a summary judgment may flow from it." (internal citations omitted)). Given the "liberal thrust" of the federal rules, *see Daubert*, 113 S. Ct. at 2794 (internal quotation omitted), it is particularly important that the side trying to defend the admissibility of evidence be given an adequate chance to do so. Moreover, fairness suggests that each side should have an equal opportunity to depose the other side's experts.[4]

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[4] Rule 104(a) generally allows a trial court conducting a pre-trial hearing to consider evidence that would not be admissible at trial. As we stated in *United States v. Downing*, 753 F.2d 1224 (3d Cir. 1985), during a pre-trial admissibility hearing, a "trial court may

In this case, however, where we had yet to articulate our specific concern with depositions prior to the ruling of the district court, we conclude that the district court did not abuse its discretion in allowing experts, who had provided affidavits, to testify at the *in limine* hearing without being deposed.[5] Moreover, the defendants submitted the affidavits of their experts four weeks prior to the hearing, so that the plaintiffs had a significant opportunity to prepare for the testimony of defendants' experts. They also had extensive leeway *at* the *in limine* hearing, where the conservation of the time of the jury was not implicated, to consult with their experts regarding any new arguments presented by defendants experts. Under these circumstances, whatever unfairness to the plaintiffs that resulted from their inability to depose defendants' experts is not sufficient to warrant a reversal for depositions and a new *in limine* hearing.

B. *Exclusion of Opinion of Experts for Whom No. 26 (b)(4) Statements Were Filed*

In the June 4, 1991, scheduling order setting deadlines for designation of defense experts discussed above, the district court required plaintiffs to designate on or before March 17, 1992, "all trial expert witnesses and provide defendants with the substance of their trial testimony and the basis of their opinions at the time of designation in accordance with Rule 26(b)(4)." On July 17, 1992, four months after the deadline for designating experts and two weeks before the scheduled trial date, the plain-

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consider, *inter alia*, offers of proof, affidavits, stipulations . . ." 753 F.2d at 1241. By announcing a general presumption in favor of depositions before *Daubert* hearings, we do not intend to imply that all procedural protections of a trial apply at an *in limine* hearing. But depositions should generally be allowed in connection with a *Daubert* exercise.

[5] We note that plaintiffs themselves relied on the expert testimony of Richard Glerzcak, who had not been designated as a trial expert.

tiffs filed a joint pretrial memorandum in which they named three expert witnesses, Drs. Calesnick, Barsotti, and Zahalsky, who had not been identified in plaintiffs' March 1992 Rule 26(b)(4) statements. Plaintiffs also named Drs. Nicholson and Jenkins as fact witnesses even though defendants argue that they have no connection with this case and are really expert witnesses. The district court excluded all of these witnesses on the basis that plaintiffs had not named them by March 17, 1992.

Plaintiffs assert that because Drs. Calesnick, Barsotti, and Zahalsky provided opinions in 1988 before the *first* summary judgment decision, the plaintiffs had designated them as experts *before* March 17, 1992, as required by the district court's scheduling order. Moreover, plaintiffs argue, even if they violated the pre-trial order, the district court abused its discretion in sanctioning them by excluding the witnesses under the factors we set forth in *Meyers v. Pennypack Woods Home Ownership Ass'n*, 559 F.2d 894 (3d Cir. 1977). We do not reach the merits of the district court's ruling.

Plaintiffs did not rely on these witnesses to oppose summary judgment. In fact, the plaintiffs did not even list these witnesses as trial witnesses until July 17, nine days after they had filed their opposition to summary judgment. As a result, our consideration of whether the district court was correct to grant summary judgment does not depend on whether the district court properly excluded these witnesses. "Where a party opposing a motion for summary judgment has the burden of persuasion, and the moving party has identified sufficient facts of record to demonstrate that no genuine issue of material fact remains, the nonmoving party is obliged to identify those facts of record which would contradict the facts identified by the movant." *Childers v. Joseph*, 842 F.2d 689 (3d Cir. 1988). *See also Celotex Corp. v. Catrett*, 477 U.S. 317, 322, 106 S. Ct. 2548, 2552-53 (1986). If the plaintiffs wished to rely on the opinions of Drs. Calesnick

Barsotti, Zahalsky, Nicholson and Jenkins to oppose summary judgment, they were required to identify the relevant facets of this testimony in their opposition to summary judgment.

Nonetheless, because we are reversing the grant of summary judgment with respect to some plaintiffs and some issues, whether these witnesses can testify at trial may still matter on remand. We could therefore decide whether the district court's original decision excluding these witnesses was an abuse of discretion, the matter having been properly put before us. However, we decline to do so, preferring to allow the district court to reconsider its decision in light of the additional time that will be available to the defendants to depose the witnesses.

In excluding the witnesses originally, the district court partly relied on the proximity of the trial date to the revelation by plaintiffs of their intent to call these experts. And proximity is indeed one important factor.[6]

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[6] *Compare Semper v. Santos*, 845 F.2d 1233, 1237-38 (3d Cir. 1988) (upholding the district court's exclusion of an expert witness who had not been named by the deadline set by the court, where the existence of the expert only became apparent *one day before trial* and where the expert's testimony was not that important); *Coleco Industries Inc. v. Berman*, 567 F.2d 569-70 & n.14 (3d Cir. 1977) (upholding the district court's exclusion of a study propounded by plaintiff's expert *in the midst of a complex trial* where counsel had no excuse for its failure to advise the court of the testimony in accord with the court's prior order); *United States v. 68.94 Acres of Land*, 918 F.2d 389, 396-97 (3d Cir. 1990) (upholding the exclusion of plaintiff's expert when, *at trial*, the expert relied on data that plaintiffs had failed to disclose in accord with a pretrial order); *with Meyers v. Pennypack Woods Home Ownership Ass'n*, 559 F.2d (3d Cir. 1977) (reversing the exclusion of the witnesses' testimony where the failure to include the witnesses in the pretrial memoranda was not a result of bad faith but of late discovery of the witnesses, the plaintiff informed the defendant of the discovery of the witnesses *three weeks before trial* but defendant did not attempt to gain information about these witnesses; and the possibility existed of postponing the trial for a few days, conducting further discovery and taxing the costs to the plaintiff).

When the plaintiffs named these experts in July of 1992, two weeks before trial, giving defendants a significant time to depose them would have required delaying a long scheduled trial in a complex case that had already gone on for years. But after remand, the district court will easily be able to give the defendants significant time to depose the plaintiffs. In sum, in light of the changed circumstances that will be present upon remand, we choose not to determine whether the district court's original decision constituted an abuse of discretion.

V. LEGAL STANDARDS FOR THE ADMISSIBILITY OF EXPERT OPINION

The district court excluded plaintiffs' remaining experts under Rules 702, 703, and 403. While the district court, the plaintiffs, and the defendants basically agree on the legal standards to be applied in analyzing admissibility, they also have some significant differences which repeatedly surfaced throughout the disputes over the admissibility of particular testimony. Accordingly, before analyzing the admissibility of the testimony of particular experts, we will first provide an overview of the legal standards under which we will evaluate that admissibility. Such an overview is also important in light of the Supreme Court's recent decision in *Daubert,* which, although it largely adopted the Rule 702 test we announced in *Downing,* works certain changes in our jurisprudence on the admissibility of expert opinions.

A. *Rule 702*

Rule 702 provides that:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

1. Qualifications

Rule 702 has two major requirements. The first is that a witness proffered to testify to specialized knowledge must be an expert. We have interpreted this requirement liberally. *See Paoli I*, 916 F.2d at 855. We have held that a broad range of knowledge, skills, and training qualify an expert as such. *See id.* at 855. In *Paoli I* we ruled that the district court had abused its discretion in excluding the opinions of Drs. Barsotti, Zahalsky, and Nisbet. We explained that exclusion was not the proper remedy "simply because the experts did not have the degree or training which the district court apparently thought would be most appropriate." *Id.* at 856.

Defendants submit that when this court held that Rule 702 mandates a policy of liberal admissibility, all that it was doing was eliminating any requirement that a candidate have specific formal qualifications such as a degree in a particular field. They assert that we were simply directing the trial court to focus on the "substance of a proffered expert's background and its fit with respect to the issue at hand." Thus, defendants suggest, when a trial court evaluates an expert's substantive rather than formal qualifications, it does not have to use a liberal policy of admission.

But this is incorrect. Rule 702's liberal policy of admissibility extends to the substantive, as well as the formal qualification of experts. We have eschewed imposing overly rigorous requirements of expertise and have been satisfied with more generalized qualifications. *See Hammond v. International Harvester Co.*, 691 F.2d 646, 652-53 (3d Cir. 1982) (holding that an engineer, whose only qualifications were sales experience in the field of automotive and agricultural equipment and teaching high school automobile repair, nevertheless could testify in a products liability action involving tractors); *Knight v. Otis Elevator Co.*, 596 F.2d 84, 87-88 (3d Cir. 1979) (holding that an expert could testify that unguarded ele-

vator buttons constituted a design defect despite expert's lack of specific background in design and manufacture of elevators). As we explain below, however, the level of expertise may affect the reliability of the expert's opinion.

2. Reliability

The second requirement of Rule 702 is that the expert must testify to "scientific, technical or other specialized knowledge [that] will assist the trier of fact." Fed. R. Evid. 702. The Supreme Court recently evaluated the meaning of this requirement in *Daubert* and held that Rule 702 does not incorporate the common law *Frye* rule in which expert testimony is admissible only insofar as it is based on a technique generally accepted in the scientific community. Instead, the Supreme Court agreed with this Court's basic holding in *Downing* that an expert's testimony is admissible so long as the process or technique the expert used in formulating the opinion is reliable. *See Daubert*, 113 S. Ct. at 2794-95 ("That the *Frye* test was displaced by the Rules of Evidence does not mean, however, that the Rules themselves place no limits on the admissibility of purportedly scientific evidence. Nor is the trial judge disabled from screening such evidence. To the contrary, under the Rules the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable."); *Downing* 753 F.2d at 1237. *Daubert* explains that the language of Rule 702 requiring the expert to testify to *scientific knowledge* means that the expert's opinion must be based on the "methods and procedures of science" rather than on "subjective belief or unsupported speculation"; the expert must have "good grounds" for his or her belief. *Daubert*, 113 S. Ct. at 2795. In sum, *Daubert* holds that an inquiry into the reliability of scientific evidence under Rule 702 requires a determination as to its scientific validity. *Id.* at 2795 n.9.

Daubert suggests several factors that a district court should take into account in evaluating whether a particular scientific methodology is reliable (i.e. scientifically valid), including the testability of the expert's hypothesis ("whether it can be (and has been) tested"), *Daubert*, 113 S. Ct. at 2796, whether the methodology has been subjected to peer review and publication, the frequency by which the methodology leads to erroneous results, the existence and maintenance of standards controlling the technique's operation, and whether the methodology has been generally accepted in the scientific community.[7] *See Daubert*, 113 S. Ct. at 2796-97. We listed very similar factors a district court should consider in *Downing*. *See Downing*, 753 F.2d at 1238-39. *Daubert* lists two factors not listed in *Downing*—whether a method produces testable hypotheses and the existence of standards controlling the technique's operation, and *Daubert* leaves off its list several factors listed in *Downing*—the degree to which the expert testifying is qualified, the relationship of a technique to "more established modes of scientific analysis," and the "non-judicial uses to which the scientific technique are put." *Downing*, 753 F.2d at 1238-39; *see Daubert*, 113 S. Ct. at 2796-97. But *Daubert* specifically refuses to disavow any the particular factors we listed in *Downing*. *See* Daubert, 113 S. Ct. at 2797 n.12. And *Daubert*, like *Downing*, indicates that the inquiry as to whether a particular scientific technique or method is reliable is a flexible one. *See id.* at 2796, *Downing*, 753 F.2d at 1238-39. We now make clear that a district court should take into account all of the factors

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[7] It is important to stress that both *Daubert* and *Downing* hold that although peer review and general acceptance are not necessary conditions of reliability, they are factors a district court can take into account in assessing reliability. *See Downing*, 753 F.2d at 1238, *Daubert*, 113 S. Ct. at 2797.

listed by either *Daubert* or *Downing* as well as any others that are relevant.[8]

3. Fit

In addition to reliability, Rule 702 requires that the expert's testimony must assist the trier of fact. As we put it in *Downing*, admissibility depends in part on "the proffered connection between the scientific research or test result to be presented and particular disputed factual issues in the case." *Downing*, 753 F.2d at 1237. *See Daubert*, 113 S. Ct. at 2795-96 (explicitly adopting the "fit" requirement of *Downing*). For example, animal studies may be methodologically acceptable to show that chemical X increases the risk of cancer in animals, but they may not be methodologically acceptable to show that chemical X increases the risk of cancer in humans. *Daubert* explains that, " '[f]it' is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes." *Id.* at 2796. Thus, even if an expert's proposed testimony constitutes scientific knowledge, his or her testimony will be excluded if it is not scientific knowledge *for purposes of the case*. "Rule 702's 'helpfulness' standard requires a valid *scientific* connection to the pertinent inquiry as a precondition to admissibility." *Id.* (emphasis added). For example, in order for animal studies to be admissible to prove causation in humans, there must be good grounds to extrapo-

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[8] Thus, the factors *Daubert* and *Downing* have already deemed important include: (1) whether a method consists of a testable hypothesis, (2) whether the method has been subject to peer review; (3) the known or potential rate of error; (4) the existence and maintenance of standards controlling the technique's operation; (5) whether the method is generally accepted; (6) the relationship of the technique to methods which have been established to be reliable; (7) the qualifications of the expert witness testifying based on the methodology; and (8) the non-judicial uses to which the method has been put.

late from animals to humans, just as the methodology of the studies must constitute good grounds to reach conclusions about the animals themselves. Thus, the requirement of reliability, or "good grounds," extends to each step in an expert's analysis all the way through the step that connects the work of the expert to the particular case.

4. The roles of judge and jury: how high a threshold for reliability?

Plaintiffs' basic position in their challenge to each of the district court's admissibility decisions is that the district court improperly usurped the role of the jury by the manner in which it analyzed admissibility. Plaintiffs first argue that, so long as they have made a prima facie showing that an expert's testimony is reliable, it is up to the jury to evaluate the expert's testimony. They assert that for the judge to evaluate competing evidence on reliability before determining admissibility would force plaintiffs to prove their case twice—once to the judge in order to persuade him or her to admit the evidence and once to the jury to persuade it of liability.

But plaintiffs' position that a party who wants to introduce expert testimony must make only a prima facie showing that a technique is reliable (*e.g.*, the testimony of a single qualified expert) is specifically foreclosed by precedent. *Daubert* holds that admissibility under Rule 702 is governed by Rule 104(a), which requires the judge to conduct preliminary factfinding, to make "a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid," and thus enables the judge to exclude evidence presented in plaintiffs' prima facie case.[9] *Daubert*, 113 S. Ct. at 2796. Similarly, we held in *Downing* that "it is plain that the proponent must make more than a *prima facie* showing

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[9] Rule 104(a) states that:

> Preliminary questions concerning the qualification of a person to be a witness, the existence of a privilege, or the admissibil-

. . . that a technique is reliable." *Downing*, 753 F.2d at 1240 n.21. We added that, in contrast to the view that the admission of scientific testimony is a matter of conditional relevancy governed by Rule 104(b), "novel scientific evidence carries with it concerns over trustworthiness and reliability akin to those raised by offers of hearsay evidence. When there is a serious quuestion of reliability of evidence, it is appropriate for the court to exercise to some degree an evidentiary screening function." *Id. Cf. In re Japanese Electronic Products*, 723 F.2d 238, 276-77 (3d Cir. 1983) (implying that Rule 104(a) requires judges to make factual evaluations in making Rule 703 determinations).[10]

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ity of evidence shall be determined by the court, subject to the provisions of subdivision (b).

Rule 104(b) concerns evidence that is relevant only if certain facts are true. It directs the judge to admit such evidence provided a party provides prima facie evidence of the truth of those facts. It provides that "[w]hen the relevancy of evidence depends upon the fulfillment of a condition of fact, the court shall admit it upon, or subject to, the introduction of evidence sufficient to support a finding of the fulfillment of the condition." Fed. R. Evid. 104(b). By holding that the admissibility of scientific testimony is governed by Rule 104(a), *Daubert* clearly holds that the party seeking admissibility must make out more than a prima facie case of reliability.

[10] Plaintiffs cite *Paoli I*, 926 F.2d at 858, for the proposition that the standard for admissibility, at least with respect to accepted methodologies, is whether a reasonable person could believe the results of the scientific study. But when *Paoli I* spoke of an accepted methodology, it meant a methodology that met all the requirements of Rules 702 and 703. Only after meeting such requirements does the question become whether the methodology produced evidence sufficient to survive summary judgment—in other words whether a reasonable person could believe it.

Although *Downing* could be read to imply that scientific techniques that are not novel are automatically admissible, *see Downing*, 753 F.2d at 1232 (evidence based on techniques of uncontroverted validity is readily admissible; evidence based on novel techniques is subject to the *Downing inquiry*), we made it completely clear in *De Luca v. Merrell Dow Pharmaceuticals, Inc.*, 911 F.2d 941, 955 n. 13 (3d Cir. 1990), that the *Downing* inquiry applies whenever

This does not mean that plaintiffs have to prove their case twice—they do not have to demonstrate to the judge by a preponderance of the evidence that the assessments of their experts are *correct*, they only have to demonstrate by a preponderance of evidence that their opinions are reliable.[11] As the Supreme Court has explained in describing the effect of the preponderance standard of Rule 104(a) generally, "[t]he inquiry made by a court . . . is not whether the proponent of the evidence wins or loses his case on the merits, but whether the evidentiary Rules have been satisfied." *Bourjaily v. United States*, 483 U.S. 171, 175, 107 S. Ct. 2775, 2778 (1987).

The evidentiary requirement of reliability is lower than the merits standard of correctness. *Daubert* states that a judge should find an expert opinion reliable under Rule 702 if it is based on "good grounds," *i.e.*, if it is based on the methods and procedures of science. A judge will often think that an expert has good grounds to hold the

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"helpfulness" cannot be resolved by judicial notice. In other words, scientific testimony must always meet a helpfulness standard; if it is a technique of uncontroverted validity, this inquiry can be resolved by judicial notice. In *Daubert*, the Supreme Court agreed, finding that Rule 702 does not just apply to novel techniques, though noting that some techniques are so well established that judicial notice of their reliability is appropriate. *See Daubert*, 113 S. Ct. at 2796 n. 11.

[11] *Downing* "decline[d] to specify the foundational showing required for admissibility in traditional burden of proof terms, . . . because the balancing analysis incorporates important policy elements . . . which render the determination something more than a fact-finding." 753 F.2d at 1240. However, the Supreme Court subsequently made clear that judges should find facts under Rule 104(a) using a preponderance standard. In *Bourjaily v. United States*, while assessing the burden of proof for the admissibility of a co-conspirator's statement, the Supreme Court held that, "[w]e are therefore guided by our prior decisions regarding admissibility determinations that hinge on preliminary factual questions. We have traditionally required that these matters be established by a preponderance of proof . . ." 483 U.S. 171, 175, 107 S. Ct. 2775, 2778-79 (1987). And *Daubert* specifically applies this holding in the expert opinion context. *See Daubert*, 113 S. Ct. at 2796 n. 10.

opinion that he or she does not even though the judge thinks that the opinion is incorrect. As *Daubert* indicates, "[t]he focus . . . must be solely on principles and methodology, not on the conclusions that they generate." *Daubert*, 113 S. Ct. at 2797. The grounds for the expert's opinion merely have to be good, they do not have to be perfect. The judge might think that there are good grounds for an expert's conclusion even if the judge thinks that there are better grounds for some alternative conclusion, and even if the judge thinks that a scientist's methodology has some flaws such that if they had been corrected, the scientist would have reached a different result.

As we explained in *Paoli I*, "the reliability requirement must not be used as a tool by which the court excludes all questionably reliable evidence." *Paoli I*, 916 F.2d at 857. The "ultimate touchstone is helpfulness to the trier of fact, and with regard to reliability, helpfulness turns on whether the expert's "technique or principle [is] sufficiently reliable so that it will aid the jury in reaching accurate results.' " *De Luca*, 911 F.2d at 956 (quoting 3 J. Weinstein & M. Berger, *Weinstein's Evidence* 702[03], at 702-35 (1988)).[12] A judge frequently should find an expert's methodology helpful even when the judge thinks that the expert's technique has flaws sufficient to render the conclusions inaccurate. He or she will often still believe that hearing the expert's testimony and assessing its flaws was an important part of assessing what conclusion was correct and may certainly still believe that a jury attempting to reach an accurate result should consider the evidence.

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[12] An argument could be made that because *Daubert's* reliability requirement is grounded in the scientific knowledge language of Rule 702 rather than the language about assisting the trier of fact which grounded our opinion in *Downing*, the helpfulness inquiry is not what is important. *Daubert's* requirement of "good grounds" potentially requires more than helpfulness. Yet we think that helpfulness is still conceptually important—an expert's testimony is sufficiently grounded for the purposes of litigation only if it will help the trier of fact to reach accurate results.

See Paoli I, 916 F.2d at 857 (helpfulness requires more than bare logical relevance, but there is a strong preference for admission) (citing *Downing*, 753 F.2d at 1235).

The same standard of reliability extends to the step in the expert's analysis that "fits" his or her conclusions to the case at hand. Once again, we emphasize that the standard is not that high. For example, in *Paoli I*, we held that testimony that PCBs cause liver cancer "fit" the case even in the absence of plaintiffs who had liver cancer, because an expert's affidavit suggested that increased risk of liver cancer was probative of increased risk of other forms of cancer. *See Paoli I*, 916 F.2d at 858. Nonetheless, the standard is higher than bare relevance.[13]

In addition to arguing that the district court usurped the role of the jury by requiring more than a prima facie showing of reliability, plaintiffs submit that the district court mistakenly applied the reliability inquiry to expert testimony that should not have been subject to that inquiry. Both *Daubert* and *Downing* require that expert testimony be based on the methods and procedures, the processes and techniques of science. In *Paoli I* we suggested that so long as any deviation the expert made from a reliable method merely constituted a change in the *application* of that method, the expert's testimony remained based on a reliable scientific method. We thought that ferreting out misapplication fell within the province of the jury, and that only if the expert so altered a reliable methodology as to skew it would the reliability inquiry of *Downing* be applicable to the altered methodology. *See*

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[13] *Daubert's* statement that fit "goes primarily to relevance" is not to the contrary. 113 S. Ct. at 2795. This statement elucidates what the fit requirement is about—that the scientific knowledge must be connected to the question at issue—rather than the standard for evaluating that connection. The passages in *Daubert* quoted in the text *supra*, which indicate that the connection between the scientific knowledge and the case must itself constitute scientific knowledge, demonstrate that the standard for fit is higher than bare relevance.

Paoli I, 916 F.2d at 858. Plaintiffs assert that the district court applied the *Downing* inquiry to methodologies that merely constituted slight alterations of reliable methodologies.

However, after *Daubert*, we no longer think that the distinction between a methodology and its application is viable. To begin with, it is extremely elusive to attempt to ascertain which of an expert's steps constitute parts of a "basic" methodology and which constitute changes from that methodology. If a laboratory consistently fails to use certain quality controls so that its results are rendered unreliable, attempting to ascertain whether the lack of quality controls constitutes a failure of methodology or a failure of application of methodology may be an exercise in metaphysics. Moreover, any misappliaction of a methodology that is significant enough to render it unreliable is likely to also be significant enough to skew the methodology.

As suggested, *Daubert* inters any need for us to make such a distinction, for *Daubert*'s requirement that the expert testify to scientific knowledge—conclusions supported by good grounds for each step in the analysis—means that *any* step that renders the analysis unreliable under the *Daubert factors renders the expert's testimony inadmissible. This is true whether the step completely changes a reliable methodology or merely misapplies that methodology.*[14]

Finally, plaintiffs contend that the district court usurped the role of the jury by making admissibility decisions based on its disagreement with the *conclusions* of plaintiffs' experts. Plaintiffs are correct, of course, that *Daubert* requires the judge's admissibility decision to focus not on

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[14] Of course, if a court finds that an expert has employed a methodology only slightly different from a methodology that the court thinks is clearly reliable, the court should be more likely to accept the altered methodology than if it was evaluating that methodology as an original matter.

the expert's conclusions but on his or her principles and methodology. *See Daubert,* 113 S. Ct. at 2797. But we think that this distinction has only limited practical import. When a judge disagrees with the conclusions of an expert, it will generally be because he or she thinks that there is a mistake at some step in the investigative or reasoning process of that expert. If the judge thinks that the conclusions of some other expert are correct, it will likely be because the judge thinks that the methodology and reasoning process of the other expert are superior to those of the first expert. This is especially true given that the expert's view that a particular conclusion "fits" a particular case must itself constitute scientific knowledge—a challenge to "fit" is very close to a challenge to the expert's ultimate conclusion about the particular case, and yet it is part of the judge's admissibility calculus under *Daubert.*[15]

Thus, as we explained above, we think that the primary limitation on the judge's admissibility determinations is that the judge should not exclude evidence simply because he or she thinks that there is a flaw in the expert's investigative process which renders the expert's conclusions incorrect. The judge should only exclude the evidence if the flaw is large enough that the expert lacks "good grounds" for his or her conclusions.

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[15] The methodology/conclusion distinction remains of some import, however, to the extent that there will be cases in which a party argues that an expert's testimony is unreliable because the conclusions of an expert's study are different from those of other experts. In such cases, there is no basis for holding the expert's testimony inadmissible. *See Hines v. Conrail,* 926 F.2d 262, 274 (3d Cir. 1991) ("though [the expert's] opinion could be considered to be 'novel,' it appears that . . . his methods were not"); Kenneth J. Chesebro, *Taking* Daubert's *"Focus" Seriously: The Methodology/Conclusion Distinction,* 15 Cardozo L.Rev. 1747, 1748 (1994) ("It is completely inappropriate for either the proponent of scientific testimony or her opponent to advance Rule 702 admissibility arguments that depend on the ultimate conclusion reached by an expert.").

5. Confusion—Rule 403

In *Downing* we explained that under Rule 702, admissibility of scientific testimony turns not only on reliability but also on the possibility that admitting the evidence would overwhelm, confuse, or mislead the jury. *See Downing*, 753 F.2d at 1240. We held that in conducting this balancing inquiry, there is a presumption of helpfulness. *See id.* at 1241 (citing *Japanese Electronics*, 723 F.2d at 279). The extent to which an adverse party has had notice and the opportunity to present his or her own experts is also relevant. Moreover, a district court cannot exclude a scientific technique as too confusing and overwhelming simply based on its conclusion that scientific techniques by their very nature confuse and overwhelm the jury. There must be something about the particular scientific technique such as its posture of mythic infallibility that makes it especially overwhelming. *See id.* at 1239 (overturning the district court's exclusion of Dr. Nicholson's meta-analysis because it conclusion that his testimony was overwhelming was based merely on its scientific nature and his credentials).

We explained in *Downing* that Rule 702 analysis partly incorporates Rule 403 analysis but leaves some room for Rule 403 to operate independently. *See Downing*, 753 F.2d at 1242. For example, we noted that a judge might use Rule 403 to exclude an expert's critique of eyewitness testimony even though the critique met the requirements of Rule 702 if there was evidence of defendant's guilt other than eyewitness testimony which would make efforts to criticize eyewitness testimony a waste of time.

In *Daubert*, the Supreme Court seems to have inverted our view that much of Rule 403 analysis conflates into Rule 702; rather the Court seems to have conflated the confusion/overwhelming impact prong of our Rule 702 analysis into its Rule 403 analysis. The *Daubert* Court did not mention the confusion/overwhelming prong when discussing Rule 702 but did provide support for applica-

tion of essentially similar analysis under the rubric of Rule 403. The Court noted that Rule 403's balancing test of the probative against the prejudicial value of evidence has a special role in cases involving expert witnesses. It stated that because expert evidence is often more misleading than other evidence, Rule 043 gives a judge more power over experts than over lay witnesses. *See Daubert*, 113 S. Ct. at 2798. This, however, does not change our opinion that in order for a district court to exclude scientific evidence, there must be something *particularly* confusing about the scientific evidence at issue—something other than the general complexity of scientific evidence.[16]

6. Procedural concerns regarding the Rule 403/702 balancing test

In *Paoli I* we held that Rule 403 is rarely appropriate as a basis of *pre-trial* exclusion, because a judge cannot ascertain potential relevance until that judge has a virtual surrogate for a trial record. *See Paoli I*, 916 F.2d at 859-60. There, many of the district court's admissibility determinations were based in part on Rule 403; thus, it is important to determine whether the *in limine* hearing in the district court created the "virtual surrogate for a trial record" that we have required before exclusion is permissible. Plaintiffs argue that the *in limine* hearing did not create such a record because they did not have an opportunity to depose defendant's experts ahead of time. As compared with a trial, plaintiffs assert, this made it

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[16] The fact that *Daubert* held that Rule 702 is the primary locus of a court's gatekeeping role indicates that exclusion under Rule 403 should be rare despite the Court's later statement that Rule 403 gives judges greater power over experts than over ordinary witnesses. *Daubert's* view of the judges substantive power under Rule 403 is thus similar to our view of the judge's substantive power under the overwhelming/confusion prong of Rule 702—both give the judge slightly more power than is ordinarily the case under Rule 403 to find that evidence is more prejudicial than probative.

much more difficult to impeach defendants' experts and to bolster the claims of their own experts. We think that the *in limine* hearing conducted here was more than adequate as a basis for a Rule 403 determination—to hold otherwise given the extensive proceedings in the district court would be to require not a "virtual surrogate for a trial record" but a trial itself.

B. *Rule 703*

While Rule 702 focuses on an expert's methodology, Rule 703 focuses on the data underlying the expert's opinion. Under Rule 703:

> The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to the expert at or before the hearing. If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence.

Under our case law on Rule 703, "the proper inquiry is not what the court deems reliable, but what experts in the relevant discipline deem it to be." *In re Japanese Electronic Products*, 723 F.2d at 277. *See also De Luca*, 911 F.2d at 952; *Paoli I*, 916 F.2d at 853. We have held that the district judge must make a factual finding as to what data *experts* find reliable, *see id.* at 853, and that if an expert avers that his testimony is based on a type of data on which experts reasonably rely, that is generally enough to survive the Rule 703 inquiry. *See De Luca*, 911 F.2d at 952.

This view has been rejected by other courts in favor of the view that the judge has to make an independent evaluation of the reliability of the data. *See, e.g., Christophersen v. Allied-Signal Corp.*, 939 F.2d 1106, 1113-14 (5th Cir. 1991), *cert. denied*, 112 S. Ct. 1280 (1992); *Ealy v. Richardson-Merrell, Inc.*, 897 F.2d 1159, 1161-62 (D.C. Cir.), *cert. denied*, 498 U.S. 950, 111 S. Ct. 370

(1990). As Judge Weinstein wrote in *In re "Agent Orange" Product Liability Litigation*, 611 F.Supp. 1223, 1245 (E.D.N.Y. 1985):

> Rule 703 permits experts to rely upon hearsay. The guarantee of trustworthiness is that it be of the kind normally employed by experts in the field. . . . Nevertheless, the court may not abdicate its independent responsibilities to decide if the bases meet minimum standards of reliability as a condition of admissibility. *See* Fed. R.Ev. 104(a). If the underlying data are so lacking in probative force and reliability that no reasonable expert could base an opinion on them, an opinion which rests entirely upon them must be excluded.

Judge Weinstein's view is extremely persuasive, and we are free to express our agreement with it because we think that our former view is no longer tenable in light of *Daubert*. *See Stana v. School Dist. of Pittsburgh*, 775 F.2d 122, 130 n. 8 (3d Cir. 1985) (noting that "[o]ur authority to align this court's jurisprudence with Supre Court teaching is clear."). *Daubert* makes clear for the first time at the Supreme Court level that courts have to play a gatekeeping role with regard to experts. In stating that Rule 702 is the primary locus of the gatekeeping role, the Court implies that there are at least some secondary loci in other Rules. *See Daubert*, 113 S. Ct. at 2795. By requiring the judge to look to the views of other experts rather than allowing the judge to exercise independent judgment, current Third Circuit case law eviscerates the judge's gatekeeping role with respect to an expert's data and instead gives that role to other experts. The gatekeeping role is reduced even further by our *DeLuca* holding that the opinion of one expert that a type of data is reliable will generally be enough to render that data reliable.

We now make clear that it is the judge who makes the determination of reasonable reliance, and that for the

judge to make the factual determination under Rule 104(a) that an expert is basing his or her opinion on a type of data *reasonably* relied upon by experts, the judge must conduct an independent evaluation into reasonableness. The judge can of course take into account the particular expert's opinion that experts reasonably rely on that type of data, as well as the opinions of other experts as to its reliability, but the judge can also take into account other factors he or she deems relevant.

We think that the standard is equivalent to Rule 702's reliability requirement—there must be good grounds on which to find the data reliable. It makes sense that the standards are the same, because there will often be times when both Rule 702 and Rule 703 apply.[17] For example, expert testimony that uses animal studies must, to be admissible for the purpose of drawing conclusions about humans, meet Rule 702's requirement of "fit." This requires the court to assess whether there are good grounds for concluding that the animal studies demonstrate causation in humans. But for an expert to rely on animal studies (if their admissibility in evidence is not independently established), these studies must also meet the requirements of Rule 703—the conclusions of these studies must be data which must be of a type reasonably relied upon by experts to analyze causation in humans. If the expert's reliance on animal studies to draw conclusions about people constitutes a methodological flaw, it is a methodological "flaw" *consisting of* relying on data not of a type reasonably relied upon by experts.[18] It would be prob-

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[17] Thus, the former rule that an expert's own statement is generally sufficient to meet the burdens of Rule 703 but not to meet the burdens of Rule 702 made little sense.

[18] Arguably, animal studies that an expert relies on are not his underlying data, but rather the data that went into the animal studies in the first place are his underlying data. In *Paoli I* we implied that testimony that experts did not generally rely on animal studies to draw conclusions about humans did not make that evidence unreliable for purposes of 703; rather it might make it fail

lematic to conclude that this testimony was reliable enough to meet Rule 702 but not Rule 703—or vice versa. Testimony that is admissible as reliable under one Rule should not be inadmissible under another when the policy considerations underlying the two rules are the same.[19]

We therefore think that when a trial judge analyzes whether an expert's data is of a type reasonably relied on by experts in the field, he or she should assess whether there are good grounds to rely on this data to draw the conclusion reached by the expert. Whether experts in the field rely on this type of data will simply continue to be a

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the inquiry of 702. *See Paoli I*, 916 F.2d at 854 n. 28 (noting that it is not clear whether evidence that animal studies are irrelevant to humans pertains to reliability under 703). *Cf. De Luca*, 911 F.2d at 953 (indicating that a proper challenge to a method of statistical analysis that did not require a .05 level of statistical significance arose out of Rule 702 not out of Rule 703—the data was of the type reasonably relied on by experts because the data underlying the analysis was acceptable. This was true even if the methodology was questionable and even if relying on the data produced by the study to draw conclusions was questionable).

However, even if Rule 702 and Rule 703 never apply to the same admissibility question, we think the same reliability standard should apply under both rules because the policy considerations are the same. Moreover, applying the same standard avoids the need to make the metaphysical distinctions necessary to decide which rule applies. *See Paoli I*, 916 F.2d at 856 ("it can be difficult to determine whether the putative problem with scientific evidence lies in the underlying data itself or the method by which the data is analyzed.").

[19] This does not make the two rules redundant. There will be times when an expert's methodology is generally reliable but some of the underlying data is not of a type reasonably relied on by experts. In those cases, the expert can testify so long as he or she does not significantly rely on the unreliable data, and so long as his or her testimony survives Rule 702 without any reliance on the excluded data. Moreover, if the judge thinks that the expert would reach a different conclusion if he was not able to rely on this data, a conclusion that would no longer help the plaintiff (or defendant) to prove his or her case, the district court can exclude his opinion as irrelevant.

part of the judge's analysis. After all, the only purpose of Rule 703 was to supplant the (former) common law rule that experts could *not* (reasonably) rely on inadmissible evidence, a notion demonstrated by the Rule 703 advisory committee to be contrary to real life.

C. *Standard of Review*

A district court's ruling on admissibility of evidence is reviewed for abuse of discretion, "but to the extent the district court's ruling turns on an interpretation of a Federal Rule of Evidence our review is plenary." *De Luca*, 911 F.2d at 944. The threshold rule is, of course, one of deference. However:

> the justifications for committing decisions to the discretion of the court are not uniform, and may vary with the specific type of decisions. Although the standard of review in such instances is generally framed as "abuse of discretion," in fact the scope of review will be directly related to the reason why that category or type of decision is committed to the trial court's discretion in the first instance.

United States v. Criden, 648 F.2d 814, 817 (3d Cir. 1981). In several other areas, we have applied a heightened abuse of discretion review. *See, e.g., Brody v. Spang*, 957 F.2d 1108, 1115 (3d Cir. 1992) ("We review a denial of a motion to intervene as of right for abuse of discretion, although this review is 'more stringent' than the abuse of discretion review we apply to a denial of a motion for permissive intervention"); *Harris v. Pernsley*, 820 F.2d 592, 597 (3d Cir.), *cert. denied*, 484 U.S. 947, 108 S. Ct. 336 (1987). Under the *Harris* standard, a denial of intervention as of right should be reversed if the district court applied an improper legal standard or reached a decision that we are confident is incorrect." (internal quotation omitted)); *United States v. Miele*, 589 F.2d 659, 667 (3d Cir. 1993) (looking rigorously to see whether the district court had closely scrutinized drug

quantity when the court based its decision on the statements of an addict-informant); *cf. Malchman v. Davis*, 706 F.2d 426, 434 (2d Cir. 1983) (holding that while a court of appeals normally reviews a class action settlement for abuse of discretion "this principle [of deference] applies with less force when, as here, settlement of a class action has been negotiated before the class has been certified.").

While evidentiary rulings are generally subject to a particularly high level of deference because the trial court has a superior vantage point to assess the evidence, *see Criden*, 648 F.2d at 818, evaluating the reliability of scientific methodologies and data does not generally involve assessing the *truthfulness* of the expert witnesses and thus is often not significantly more difficult on a cold record. Moreover, here there are factors that counsel in favor of a hard look at (more stringent review of) the district court's exercise of discretion. For example, because the reliability standard of Rule 702 and 703 is somewhat amorphous, there is a significant risk that district judges will set the threshold too high and will in fact force plaintiffs to prove their case twice. Reducing this risk is particularly important because the Federal Rules of Evidence display a preference for admissibility.[20] *See Daubert*, 113 S. Ct. at 2794.

Factors like those just discussed influence the scope of our review of a district court's discretion. For example, where rules display a preference for a particular outcome, our review of decisions under those rules is sometimes more searching. *See United States v. Pennsylvania Department of Envir't Resources*, 923 F.2d 1071, 1074 (3d Cir. 1991) ("[T]he traditional discretion of the federal courts to decide whether to hear declaratory judgment cases is not limited by *Colorado River* and *Moses H.*

[20] Indeed, a similar gloss may be gleaned from the Seventh Amendment's guarantee of a right to a jury trial when a party with a legal claim demands one.

Cone, but will be subject to the liberal interpretation to be accorded the Declaratory Judgment Act. Given our correspondingly enlarged scope of review . . ., the district court's declination to exercise jurisdiction . . . is not consistent with a sound exercise of judicial discretion." (internal quotation omitted)). Moreover, the likelihood of finding an abuse of discretion is affected by the importance of the district court's decision to the outcome of the case and the effect it will have on important rights. *See Maroquin-Manriquez v. Immigration and Naturalization Service*, 699 F.2d 129, 134 (3d Cir. 1983) (abuse of discretion will only be found in discovery if there has been interference with a substantial right or fundamental unfairness at the trial has resulted.); *cf. Mathews v. Eldridge*, 424 U.S. 319, 334, 96 S. Ct. 893, 902 (1976) (the procedural safeguards required by due process increase as the importance of the decision being made increases).

We acknowledge that there is arguably a tension between the substantial deference normally accorded to rulings where the trial court has a superior vantage point and the preference for admissibility of the Federal Rules of Evidence. We resolve any such tension by holding that when the district court's exclusionary evidentiary rulings with respect to scientific opinion testimony will result in a summary or directed judgment, we will give them a "hard look" (more stringent review, *cf. Brody v. Spang*, 957 F.2d at 1115) to determine if a district court has abused its discretion in excluding evidence as unreliable.[21]

D. *The Role of Pennsylvania's Requirement of Reasonable Medical Certainty*

Pennsylvania requires experts to testify that defendant's actions caused plaintiff's illness with a reasonable degree

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[21] Of course, it remains true that if the scintilla of evidence presented is insufficient to allow a reasonable juror to conclude that the position more likely than not is true, the court remains free to direct a judgment, *see* Fed. R. Civ. P. 50(a), and likewise to grant summary judgment, Fed. R. Civ. P. 56.

of medical certainty, *see Cohen v. Albert Einstein Medical Ctr.*, 592 A.2d 720, 724 (Pa.Super. 1991), *appeal denied*, 602 A.2d 855 (Pa. 1992) ("Expert testimony is admissible when, taken in its entirety, it expresses reasonable certainty that the accident was a substantial factor in bringing about that injury. The expert need not express his opinion in precisely the same language we use to enunciate the legal standard.") (quoting *Kravinsky v. Glover*, 396 A.2d 1349 (Pa. Super. 1979) (citation within *Kravinsky* omitted). The issues presented by this appeal require us to determine whether this rule governs in federal court. Because it will facilitate our discussion of the individual evidentiary rulings if we do so in the earlier portions of the opinion, we turn our attention to the question now.

If the rule conflicts with federal rules and is "rationally capable of classification" as procedural rather than substantive, then, as a federal court, the district court ignores the rule and applies federal rules instead. *See Hanna v. Plumer*, 380 U.S. 460, 472, 85 S. Ct. 1136, 1144 (1965). But "the determination of whether a particular evidentiary ruling involves federal procedural law or state substantive law, can be difficult. Often admissibility issues overlap with substantive concerns such as standards of proof." *Schulz v. Celotex Corp.*, 942 F.2d 204, 207 (3d Cir. 1991).

In *Schulz*, we refrained from deciding whether New Jersey's requirement that a medical expert testify with "reasonable medical certainty" was procedural or substantive, because we held that the federal rules, like the New Jersey rules, also required that, at a minimum, a physician be able to "form an opinion with sufficient certainty so as to make a medical judgment," *id.* at 209, and that this was enough to decide the particular case. Thus, while *Schulz* did not require the specific words "reasonable degree of medical certainty," testimony about "possibilities" or even "strong possibilities" was not admissible (though testimony made without qualifications was admissible).

Id. at 208. The issue is framed here primarily by an instance in which Dr. Sherman stated her conclusion with more certainty than a "strong possibility" (she stated that PCBs were a "significant factor" in Amber Burrell's diminished ankle reflexes) but was unwilling to testify that she had reached that conclusion with a reasonable degree of medical certainty. (The issue also arises with respect to other pieces of evidence.) Thus, we must decide whether experts were required to testify with a reasonable degree of medical certainty.

We conclude that they were. Although if it were purely a rule of admissibility Pennsylvania's standard would not apply in federal court. Pennsylvania's rule also constitutes part of the plaintiff's burden of proof. As a rule of admissibility, Pennsylvania's standard is in conflict with Rules 702 and 703 which require a reasonable degree of medical certainty. *See United States v. Cyphers*, 553 F.2d 1064, 1072 (7th Cir.), *cert. denied*, 434 U.S. 843, 98 S. Ct. 142 (1977) upholding a district court's admission of expert testimony that was not based on reasonable scientific certainty); *cf. Daubert*, 113 S. Ct. at 2794 (holding that the *Frye* rule requiring a methodology to be generally accepted was not part of the Federal Rules of Evidence); *but see Grant v. Farnsworth*, 869 F.2d 1149 (8th Cir. 1989), *cert. denied*, 493 U.S. 898, 110 S. Ct. 252 (1989) (upholding the district court's exclusion of expert testimony where a chiropractor could not state the causes of plaintiff's disability with a reasonable degree of medical certainty).

If Pennsylvania's rule were only a standard of admissibility in conflict with Federal Rules of Evidence, Pennsylvania's rule would be "rationally capable of classification as procedural" and the Federal Rules of Evidence would govern. *See, e.g., Salas v. Wang*, 846 F.2d 897, 904-06 (3d Cir. 1988) (holding that under the Federal Rules of Evidence, an expert could testify to aggregate

damages and that this rule was procedural, thus trumping New Jersey's opposite rule). However, we think that Pennsylvania's rule is more than a requirement of admissibility, but rather it is an element of plaintiff's burden of proof. In *Cohen,* the Pennsylvania Superior Court stated that:

> When a party must prove causation through expert testimony the expert must testify with reasonable certainty that in his professional opinion, the result in question did come from the cause alleged . . . [I]f the plaintiff's . . . expert cannot form an opinion with sufficient certainty so as to make a [professional] judgment, there is nothing on the record with which a [factfinder] can make a decision with sufficient certainty so as to make a legal judgment.

Cohen, 692 A.2d at 723 (quoting *Kravinsky v. Glover,* 396 A.2d 1349 (Pa. Super. 1979)) (internal quotations omitted). Thus, the *Cohen* court strongly implied that, even if admissible, testimony with less than a reasonable degree of medical certainty was insufficient to prove causation. *See also id.* (stating that this was "[t]he degree of medical certainty necessary to prove causation.").

As part of the burden of proof, then, Pennsylvania's rule is a substantive one, not in conflict with Federal Rules of Evidence, and thus governs in federal court. *See, e.g., Herber v. Johns-Manville Corp.,* 785 F.2d 79, 81-82 (3d Cir. 1986) (holding that New Jersey's requirement that a plaintiff must show a "reasonable medical probability" of future injury in order to recover for that injury governed in federal court). As a result, in analyzing the testimony of Dr. Sherman and other witnesses with respect to particular plaintiffs, we will uphold the district court's grant of summary judgment for the defendants in those instances when the plaintiffs' expert states that he or she could not testify that a plaintiff's illness was caused by PCBs with a reasonable degree of

medical certainty. We turn to application of the foregoing principles to the record in this case.

VI. THE RELATIONSHIP BETWEEN PCBs AND PLAINTIFFS' ILLNESSES

In order to sustain their traditional tort claims, i.e. other than for medical monitoring, the personal injury plaintiffs must show that they were exposed to the chemicals released by the defendants, that these chemicals can cause the types of harm they suffered, and that the chemicals in fact did cause them harm. We begin our analysis at the last step, because this is the step at which it is easier to winnow the claims on which the plaintiffs have presented admissible testimony.

Eleven of the Kohn/Klehr plaintiffs offered Janette D. Sherman, M.D. as an expert in internal medicine and toxicology. They proposed to have Dr. Sherman testify: (1) that they had been exposed to PCBs and other toxic chemicals; (2) that the toxic chemicals had caused adverse health effects in the various plaintiffs including high blood pressure, lung disease, asthma, elevated triglycerides, aortic sclerosis and eventual death, arthritis, respiratory infections and a history of miscarriages; and (3) that exposure to these chemicals poses an increased risk for various plaintiffs of developing cancer or other illnesses in the future. These plaintiffs also proffered Dr. Sherman to show that they require regular medical monitoring. The district court excluded Dr. Sherman's testimony holding that she lacked the requisite expertise, that her methodology was unreliable, and that the probative value of her testimony was substantially outweighed by unfair prejudice and undue delay.

Nine plaintiffs, those represented by Bruce Hanes, called Dr. G. John DiGregorio to testify that the plaintiffs' present injuries were caused by PCB exposure, that they have an increased and reasonable fear of future injuries, and that a medical monitoring program, which Dr. Di-

Gregorio would design, should be implemented for plaintiffs. (A2634-35). Dr. DiGregorio received both a Ph.D. in pharmacology and an M.D. from Hahnemann Medical College and is a professor in pharmacology and medicine at Hahnemann. The district court accepted Dr. DiGregorio as a qualified expert but excluded his testimony regarding personal injuries as unreliable.

We will begin our analysis by evaluating Dr. Sherman's qualifications and will reverse the district court's exclusion of Dr. Sherman as an unqualified expert. We will next briefly examine the district court's exclusion of the immunological tests relied on by Dr. Sherman for some of her diagnoses and will uphold that exclusion. We will then discuss the defendants' claims that Drs. Sherman and DiGregorio engaged in too few of the standard diagnostic techniques of "differential diagnosis," and failed seriously to consider the possibility of alternative causes of plaintiffs' illnesses other than exposure to PCBs. After describing the critique, we will apply *Daubert* to analyze generally what makes a doctor's method of differential diagnosis so unreliable as to be within the district court's power to exclude it. We will then apply this framework to the assessment of individual plaintiffs that Dr. DiGregorio and Dr. Sherman made. We will uphold the district court's exclusion of the testimony of Dr. Sherman and Dr. DiGregorio for the assessment of present injuries with the exception of Dr. Sherman's testimony regarding Bessie Cunningham and Amber Burrell.

A. *Dr. Sherman's Qualifications*

Dr. Sherman is a 1964 graduate of the Wayne State University School of Medicine. Following a one year internship at Wayne State University Hospital and a two year fellowship funded by the National Institutes of Health to study diabetes, she practiced internal medicine full time from 1970-76. Since that time she has apparently been engaged in the full time practice of forensic medicine. Dr.

Sherman is the author of 22 articles and of the book *Chemical Exposure and Disease—Diagnostic and Investigative Techniques.* She served for six years on a 16 person advisory committee to the EPA that was convened in connection with the adoption of the Toxic Substance Control Act—an Act largely concerned with PCBs. She was on the consulting staff of Harper Hospital in Detroit until 1988 and is still on its correspondence staff. A. 5086-87.

The district court held that Dr. Sherman was not qualified to testify as an expert. It explained that Dr. Sherman no longer practices general internal medicine—she does not have admitting privileges at any hospital and lacks an office where she can examine patients. Since 1976 most of her work has consisted of consulting for litigation; she has been involved in 800 cases and has been on the plaintiffs side in all but two. According to the district court, out of fifty patients she has examined who have been exposed to PCBs, she cannot remember one instance in which she found that PCBs had not caused adverse health effects. A. 5124.

Moreover, the district court noted, Dr. Sherman lacks board certification in any medical specialty including internal medicine and toxicology, and admits that she is not an expert in immunology, oncology, neurology, psychiatry, dermatology, epidemiology or exposure assessment. Although Dr. Sherman represents that she became an expert in toxicology through experience, reading, writing, teaching, evaluating patients and course work, she took no courses on toxicology in medical school, and the district court concluded that it did not observe anything in her testimony to indicate that her reading was of a serious naure.

Finally, the district court credited defendants' witnesses who testified that, during the course of her testimony, Dr. Sherman made numerous basic medical errors in the fields of immunology, internal medicine and dermatology. The court referred to several examples cited by defendants' ex-

perts. Dr. Jordan Fink, Professor of Medicine and Chief of the Allergy Immunology Division at the Medical College of Wisconsin, testified that Dr. Sherman incorrectly excluded essential hypertension, the name for the 80% of hypertension with an unknown cause, from her list of the causes of hypertension, incorrectly stated that cells in the immune system transport skin pigment cells, and referred to "myelin cells" which do not exist. Dr. James Leyden, a professor at the University of Pennsylvania Medical School, who has twice won the gold medal from the American Academy of Dermatology, stated that Dr. Sherman incorrectly asserted that one could not distinguish between chloracne and acne based on their appearance—a distinction which, in his view, any qualified dermatologist could easily make. Drs. Michael Weitekamp, Robert Morgan and Paul Roediger pointed out similar errors in Dr. Sherman's testimony. And Dr. Fink concluded that these gaps in knowledge were "major deficits. They—these items should be right in the forefront of knowledge of any internist, any resident, any medical student." The district court concluded that these "major deficits" removed Dr. Sherman from the category of expert.

We disagree. We hold that Dr. Sherman, while arguably a relatively poor clinician and less than fully credible witness, qualifies as an expert. She was on the consulting staff of a hospital until she moved from Michigan in 1988. Since then she has had extremely broad experience in the field of toxic substances, has written extensively in the field and has consulted for the American Legion Science Panel—a group of experts analyzing scientific issues, such as dioxin poisoning, that effect veterans. The fact that most of her work since 1976 has been for plaintiffs in litigation may undermine her credibility but does not eradicate her expertise. For litigants to have access to experts, it may be necessary for some experts to concentrate on litigation.

Dr. Sherman apparently made substantive mistakes in her testimony, but that testimony also demonstrated sig-

nificant familiarity with the literature on PCBs; indeed her testimony in that area, which is central to this case, was not substantially challenged. Of course, Dr. Sherman was not merely testifying about PCBs but about the relation of PCBs to diseases in particular plaintiffs. In order to testify about this relationship, she needed to know about the various diseases, and it is mostly in this area that she made mistakes. But in a deposition lasting four days, it is hardly surprising that there were a few technical errors. Indeed, many of Dr. Sherman's mistakes seem minor and unlikely to affect her ability to express an opinion (e.g. use of the word "thymus" instead of "thyroid," use of the terms "myelin cells" instead of "myelin containing cells").

Others of Dr. Sherman's "mistakes" are hard to judge. For example, her reference to the movement of skin pigment referred to pigment that developed in nails and skin as a result of exposure to PCBs rather than to general skin pigment (A791, A5114)—and whether this type of pigment moves is unclear. However, some of the mistakes Dr. Sherman made, such as her contention that acne and chloracne look the same, seem significant for diagnostic purposes.[22] Moreover, the number of mistakes she made was quite significant.

Nonetheless, the mistakes Dr. Sherman made do not render her unqualified as an expert for purposes of Rule 702. If the liberal standard of Rule 702 allows an engi-

[22] Plaintiffs contend that Dr. Sherman's alleged claim that acne and chloracne look the same arise from a misreading of her testimony. In their submission, Dr. Sherman was testifying only that the precursors of chloracne might look the same as acne, and because defendants' expert had not ever seen the precursors to chloracne, he was in no position to say she was wrong. As we see it, this contention is specious, for Dr. Leyden, a renowned expert on dermatology, testified that he had never seen chloracne in anything but a full blown form and strongly implied that this was the only visible form. But he also admitted that many internists probably could not tell the difference between chloracne and acne. A 4954. And Dr. Weitekamp, one of defendants' experts, stated that he could not distinguish chloracne and acne. A4296.

neer who teaches auto mechanics to testify in a products liability action about tractors, *see Hammond v. Int'l Harvester Co.*, 691 F.2d 646 (3d Cir. 1982), *supra* at p. 40, it surely allows a trained internist who has spent significant time reviewing the literature on PCBs to testify as to whether PCBs caused illness in plaintiffs. In light of *Hammond,* Rule 702 does not require plaintiffs to hire separate experts on the relationship between PCBs and diabetes, PCBs and chloracne, PCBs and cancer etc.; it is likely that none such exist, and the cost would be prohibitive. Under our liberal standards for qualifications of experts, the district court's decision that Dr. Sherman was not a qualified expert was an abuse of discretion.

B. *Rule 703 and Dr. Sherman's Immunological Tests*

The district court also held that some of the data on which Dr. Sherman relied, immunological test results from a chemical injury kit, were not the type of data reasonably relied upon by experts in the field under Rule 703. The district court based its holding on the fact that the lab work was performed by an unaccredited laboratory and the fact that two of defendants' experts testified that the tests were not important, would probably be more misleading than helpful, and had been misinterpreted. Plaintiffs cite Dr. Sherman's testimony for the proposition that she did not rely on these tests. Defendants respond that these tests were often the *only* basis she cited for her conclusion that PCBs had caused plaintiffs' injuries.

We will analyze the importance of the tests to Dr. Sherman's testimony when we analyze her testimony with respect to the particular plaintiffs. *See supra* p. 54 n. 19 (explaining what a court should do when an expert testifies based in part on data deemed unreliable under Rule 703). However, since the plaintiffs do not defend the tests themselves, there is no real dispute that they may not be the basis for any of Dr. Sherman's conclusions. If Dr. Sherman is allowed to testify, she will not be allowed to rely on these tests.

C. *Adequacy of Dr. Sherman's and Dr. DiGregorio's Use of Differential Diagnosis in Evaluating Causation of Present Illnesses*

1. The district court's critique

The district court also excluded Dr. Sherman's testimony under the helpfulness prong of Rule 702. It believed defendants' seven witnesses who opined that Dr. Sherman did not employ differential diagnosis, the basic method of internal medicine. Dr. Fink testified that an internist should inquire of the patient about his or her complaint(s), the history of the complaint(s), any other illnesses the patient might have, the patient's occupation, and habits such as smoking. In his view, the internist should then use differential diagnosis to rule out possible alternative diseases and causes of these diseases by outlining the possibilities and then narrowing them down based on the doctor's experience. For example, even if plaintiffs were exposed to PCBs and PCBs are dangerous, a doctor employing proper methodology could not conclude that PCBs were a substantial factor in the cause of an illness without thinking about other potential causes.

More particularly, according to Dr. Fink, before a doctor could reasonably conclude that PCBs contributed to an individual's lung cancer, she would have to ask whether the individual was a smoker, and if that individual was a smoker, she would have to take steps to determine whether the individual's lung cancer was more consistent with exposure to smoking or PCB exposure or both. She would also have to consider the history of the person's exposure to both PCBs and cigarettes, and would have to perform laboratory tests and physical examinations to determine the likely cause(s).

According to the district court, Dr. Sherman failed to employ any of the ordinary methods doctors use to narrow down the cause of disease. She did not order standard laboratory tests to be performed on plaintiffs (ordering

only unhelpful immunological tests from an unaccredited laboratory), physically examined only two of the thirteen plaintiffs about whom she offered opinions,[23] and took medical histories only from the two plaintiffs she examined physically.[24] The district court noted that Dr. Fink testified that it is standard medical practice to take medical histories and conduct physical examinations, and that it would not be appropriate to base a patient's care solely on medical records from the patient's prior physicians. Similarly, Dr. Weitekamp testified that without going through the entire process outlined above, it is difficult to make a

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[23] In their briefs, plaintiffs state that Dr. Sherman examined three of them. But in the supplemental materials that the plaintiffs sent to us detaiilng the evidence presented by each plaintiff, there is only evidence that Dr. Sherman examined two plaintiffs.

[24] Dr. Sherman had not examined any of the plaintiffs by the March 2, 1992, deadline for completition of discovery. The plaintiffs asked for an extension of discovery to allow Dr. Sherman, who had been in Hawaii from December 1991 to April 1992, to examine them. (A498-99). On April 8, 1992, defendants wrote to the district court requesting that Dr. Sherman be required to complete medical examinations on or before April 23 (A526-27). Plaintiffs agreed to the defendant's proposed April 23 deadline (A 529) and Dr. Sherman examined some of the plaintiffs by that time. On April 24th the Clerk of the Court entered an order refusing to extend the discovery deadline and precluding Dr. Sherman from taking examinations of any of the plaintiffs.

Plaintiffs contend that the district court's order was unfair, and explains Dr. Sherman's failure to examine more of the plaintiffs. However, plaintiffs neither reference the district court's ruling in their notice of appeal nor list this ruling in their brief as an issue on appeal. Thus, plaintiffs are merely attempting to use this district court order as a means to make Dr. Sherman's failure to examine all plaintiffs appear reasonable. But it was plaintiffs who failed to comply with the district court's reasonable order. At all events, if Dr. Sherman's failure to examine patients makes her methodology unreliable, it does so regardless of whether the cause of that failure was externally imposed. Moreover, as plaintiffs acknowledge, they agreed that Dr. Sherman would conduct all physical exams by April 23, 1992, and they received until April 24 to conduct these exams.

complete diagnosis, and that Dr. Sherman did not perform a differential diagnosis.

The district court also relied on the fact that Dr. Sherman did not even consider alternative causes for various diseases. The court pointed to the testimony of Dr. Fink and Dr. Roediger, both of whom implied that the real problem with Dr. Sherman's methodology was not that she was unaware of possible alternative causes but that she did not *really* consider them.[25] Defendants note that, despite her testimony that she had employed differential diagnosis and had considered alternative causes. when asked about specific findings of causation. Dr. Sherman acknowledged that she had not looked at nor ruled out alternative causes for plaintiffs' illnesses including high blood pressure, stomach cancer, asthma, episcleritis or anemia. Moreover, Dr. Roediger tesitfied that, "I do not feel that the concept of ruling out the commonest causes of diseases was ever displayed in her testimony in a fashion that would portray her as a competent internist." This was because she did not give evidence of having considered the common causes of many of the diseases she diagnosed. On this basis, the district court held that Dr. Sherman's methodology was unreliable.

For similar reasons, the district court excluded the testimony of Dr. DiGregorio. In some ways Dr. DiGregorio's methodology was more complete than was Dr. Sherman's. He took a limited medical history of each plaintiff—asking about their family medical history. He also had a blood test and a fat biopsy performed on each plaintiff to test for PCBs. Nonetheless, in other ways Dr. DiGregorio's analysis was more limited than that of

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[25] Although plaintiffs argue that Dr. Fink conceded that he did not know what Dr. Sherman's methodology was (A4883-4884), which they say means he could not judge it, in actually Dr. Fink was saying that there was no evidence that she had employed *any* methodology, and no evidence that she really considered any alternative causes. (A4867, A4883).

Dr. Sherman. Dr. DiGregorio did not even look at medical records of the plaintiffs much less examine them. With selective exceptions, Dr. DiGregorio's methodology was to have each plaintiff mark their symptoms on a checklist, answer questions about their family medical history, discuss the answers they had given on the checklist, and obtain blood and fat samples to be tested for PCBs.

The district court applied the testimony offered by defendants about Dr. Sherman to the methodology of Dr. DiGregorio.[26] It found that differential diagnosis which is used to rule in or out alternative causes is the "hallmark" of internal medicine and that Dr. DiGregorio had not employed it. The court found that Dr. DiGregorio had intended to use differential diagnosis but had not performed the examinations and tests that he as well as defendants' experts thought were necessary to render

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[26] Plaintiffs argue that until August 6, 1992 they had no notice that defendants intended to challenge Dr. DiGregorio's methodology with testimony directed at Dr. Sherman. They contend that this late notice was fundamentally unfair. In the absence of this testimony, specific application of the testimony directed at Dr. Sherman to Dr. DiGregorio, or other testimony indicating that Dr. DiGregorio's methodology was unreliable, plaintiffs submit that defendants were not even entitled to a hearing on whether the testimony should be excluded. We think that the defendants are right that the district court was fair in viewing the testimony of defendants' experts as addressing Dr. DiGregorio's methodology as well as Dr. Sherman's methodology. The Hanes plaintiffs expressly relied on the testimony of the Kohn plaintiffs' experts as part of their case and thus had reason to be aware of challenges to Dr. Sherman's methodology and of the fact that it would apply equally to the testimony of their own expert. Moreover, the district court pointed to the testimony of Dr. DiGregorio himself as showing that his methodology was unreliable and, as defendants note, Dr. DiGregorio's methodology was condemned in affidavits in 1988 and was criticized in Dr. Weitekamp's deposition in 1992 (A6968-75); Dr. DiGregorio was asked about his methodology at length during his 1992 deposition (A3089-3149). Thus plaintiffs' contention is without merit.

"a correct, final diagnosis." The court found that Dr. DiGregorio admitted that, until he physically examined plaintiffs, he would not even be able to know if they suffered any injuries caused by PCBs. Yet Dr. DiGregorio did not perform these tests or examinations in the four years between his 1988 deposition and his 1992 deposition, although he had testified in 1988 that he planned to perform these tests and exams and that they could be completed in six months.

According to the district court, Dr. DiGregorio's failure to perform these tests not only left him with little information about plaintiffs' actual injuries, it left him with little information about causation. The court cited examples of Dr. DiGregorio being unaware of activities engaged in by plaintiffs that were possible alternative causes of their injuries, such as excessive alcoholic drinking as an alternate cause of Craig Brown's elevated LDH, and taking the birth control pill Ortho-Novum as an alternate cause of Cathlene Brown's bruising. The court observed that Dr. DiGregorio had simply concluded that all of the plaintiffs' symptoms were caused by exposure to PCBs "until proven otherwise."

As a result of the foregoing, the court found that Dr. DiGregorio's methodology was incomplete and therefore would not be helpful to the jury under Rule 702. In the court's view, by failing to consider alternative causes, Dr. DiGregorio's testimony would force the jury arbitrarily to choose one cause from many possible causes and, because Dr. DiGregorio did not examine plaintiffs' to determine that they actually had injuries, his methodology was rendered incomplete and unreliable. Finally, because Dr. DiGregorio failed to perform physical exams or many tests, the court determined that the type of data he relied on was not a type experts reasonably rely on under Rule 703. It noted in conclusion that "[t]he only opinion that Dr. DiGregorio is consistent in holding throughout his deposition is that the Plaintiffs' anxiety, fear of cancer,

depression and abnormal lab values were caused by exposure to PCBs."

2. The plaintiffs' response

The plaintiffs' attempt to revive the methodologies of Drs. Sherman and DiGregorio by arguing that the requirements of differential diagnosis are not nearly as rigorous as the district court found them to be. Plaintiffs point out that Dr. Sherman testified in the *in limine* hearing that she had used differential diagnosis since she was in medical school, and that she had done so here even with regard to those plaintiffs whom she did not examine. More particularly, she looked at medical records, which contained the results of physical exams performed by other physicians (and medical histories taken by other physicians), and at illnesses across the population, and then applied the medical literature to narrow down the cause. Dr. Sherman also testified that she *did* consider possible alternative causes before reaching her conclusions.

Similarly, while it is true that Dr. DiGregorio testified that in order to render a final opinion he would have to perform more tests, he also testified that, absent further evidence, he had enough information to conclude with a reasonable degree of medical certainty that PCBs were the cause of plaintiffs illnesses. He explained:

> When a doctor does a history and there's a cause of a problem, whether it's pneumonia, pulmonary tract infection, the differential diagnosis—the leading differential diagnosis at the time is what the doctor suspects is the immediate cause of the problem. And it's up to the doctor to proceed after that point and to prove either by physical examination or more tests whether his diagnosis is correct. So, as far as I'm concerned the symptoms that these patients gave me in the history are due to PCB exposure. Until I have the opportunity to continue on with my investigation

> they all will have, within a reasonable degree of medical certainty, that type of symptom.

Thus, he concluded, at least as a preliminary manner, that until performance of physical exams or more tests, PCBs were the cause of plaintiffs' illnesses. And in reaching this conclusion, he stated that he followed normal methodology—"[t]he differential diagnosis you make with whatever information you have at the time. What you do now is to prove your diagnosis."

In essence, plaintiffs' argument is that what Dr. DiGregorio was saying was that differential diagnosis is an ongoing process of making judgments about causation and then adapting those judgments as new information is acquired. Dr. DiGregorio then, was asserting that, when he made his "preliminary" differential diagnosis, he had sufficient information (his knowledge of plaintiffs' exposure to PCBs, his knowledge of the effects of PCBs, and the medical histories he took) reliably to conclude that PCBs were more likely than not a cause of plaintiffs' illnesses even after considering other possibilities. Thus, the question becomes whether the district court abused its discretion in concluding that Dr. Sherman and Dr. DiGregorio's methodology of assessing causation was unreliable because of the limited information they had gathered.

3. Rule 702 Analysis

The defense experts' criticisms of the methodologies of Drs. Sherman and DiGregorio were specific criticisms of the manner in which they each engaged in differential diagnosis (to the point where they asserted that Drs. Sherman and DiGregorio had not even employed differential diagnosis). Unfortunately, most of the *Daubert* factors—testability, general acceptance, peer review, and degree of production of errors, *see supra* at 42 n. 8, are of only limited help in assessing whether the methodologies of Drs. Sherman and DiGregorio are reliable (i.e. scientifically valid). We find that the final *Daubert* factor, the

existence of standards controlling the technique's operation, is slightly more helpful in deciding whether the methodologies of the plaintiffs' doctors are reliable.

While applying the first *Daubert* factor, differential diagnosis can be considered to involve the testing of a falsifiable hypothesis (e.g. that PCBs caused a plaintiff's cancer) through an attempt to rule out alternative causes, that methodology involves far more elements of judgment than does a scientific study attempting to test a more general scientific proposition. While an important aspect of assessing scientific validity (and therefore evidentiary reliability) is the ability of other scientists to test or retest a proponent's theory, differential diagnosis involves assessing causation with respect to a particular individual. This merely makes it a different type of science than science designed to produce general theories; it does not make it unreliable science. Although in terms of the remaining *Daubert* factors, differential diagnosis generally is a technique that has widespread acceptance in the medical community, has been subject to peer review, and does not frequently lead to incorrect results, it is a method that involves assessing causation with respect to a particular individual. As a result, the steps a doctor has to take to make that (differential) diagnosis reliable are likely to vary from case to case; the information a doctor needs in order to reliably assess the cause of a patient's lung cancer is often very different from the information neeeded to assess the cause of a patient's back or heart trouble.

Thus, although differential diagnosis is a generally accepted technique, no particular combination of techniques chosen by a doctor to assess an individual patient is likely to have been generally accepted. But unlike a methodology used in conducting a scientific study, lack of general acceptance is not a sign of unreliability, it is merely a result of the fact that the medical community will rarely have considered the reliability of a particular process of differential diagnosis used in an individual case. Nor is it

likely that the particular combination will have been published and subject to peer review, because a particular version of differential diagnosis will rarely be of general interest to the medical community. However, to the extent that a doctor utilizes standard diagnostic techniques in gathering this information, the more likely we are to find that the doctor's methodology is reliable. For these reasons, we must be flexible in conducting our *Daubert* inquiry.

We first note that defendants presented evidence that the methodologies of Drs. Sherman and DiGregorio were not generally accepted. Defendants' experts explained that a reliable differential diagnosis generally requires a physical examination of the patient, a review of medical records, and always requires careful consideration of alternative causes. We agree with the defendants that performance of physical examinations, taking of medical histories, and employment of reliable laboratory tests all provide significant evidence of a reliable differential diagnosis, and that their absence makes it much less likely that a differential diagnosis is reliable.[27] We reach this con-

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[27] Precedent supports our conclusion that when a doctor employs standard diagnostic techniques, his or her testimony is much more readily admissible. In *Hines v. Consolidated Rail Corp.*, 926 F.2d 262 (3d Cir. 1991), we considered the claims of a railroad worker who asserted that his diseases were caused by PCBs at the railyard. After the defendants challenged internist Dr. Harry Shubin's data and methodology as inadequate because he did not point to epidemiological studies demonstrating that PCBs caused cancer, and the plaintiff's blood level did not demonstrate the presence of PCBs above background levels, the district court excluded the testimony without an opinion or an *in limine* hearing. We reversed. While relying partly on the district court's failure to grant adequate process and partly on the low liability standard of the Federal Employers' Liability Act, 45 U.S.C. §§ 51-60, we indicated that "Shubin's intensive and personal investigation of Hines distinguishes Shubin's testimony from the testimony excluded by courts in a number of cases cited by Conrail where there was no evidence in the record that experts ever examined or tested the plaintiff (or assertions) at issue." *Id.* at 271. We observed that:

clusion in part based on the persuasive testimony of defendants' experts that these techniques are generally accepted as a standard part of differential diagnosis, and that such techniques significantly reduce the likelihood of erroneous results. We also base our conclusion on the fact that all of the experts agree that at the core of differential diagnosis is a requirement that experts at least consider alternative causes—this almost has to be true of any technique that tries to find a cause of something. Moreover, performance of standard diagnostic techniques provides prima facie evidence that a doctor has considered such causes and has attempted to test his or her initial hypothesis as to cause.

But, we agree with the plaintiffs that a doctor does not always have to employ all of these techniques in order for the doctor's differential diagnosis to be reliable. Dr.

> Shubin used traditional methods to form his opinion by reviewing a variety of background factors that are normally investigated in the medical profession, including Hines' histories of other exposures to toxins, drugs, and alcohol, the length of his residences, employment experience, PCB-related symptoms, blood tests, liver function tests, immunological tests, gas chromatograph tracings, a number of reports as well as all of the scientific literature that indicates that PCBs can be associated with severe health problems, including cancer.

Id. at 274.

It could be argued that, under *Hines*, the testimony of a doctor who engages in the traditional techniques of differential dianosis is admissible regardless of whether he offers a plausible explanation of the conclusion he reaches. We admitted Shubin's testimony because "even though Shubin's opinion [that PCBs caused plaintiff's illnesses] could be considered 'novel,' it appears that, under the *Downing* standard, his methods were not." *Id.* However, while we think that the standard techniques of differential diagnosis are reliable and will allow a doctor who employs them to testify to a novel conclusion, we also think that part of differential diagnosis is using these standard techniques to rule out alternative causes—thus, where a defendant points to a plausible alternative cause and the doctor offers *no* explanation for why he or she has concluded that was not the sole cause, that doctor's methodology is unreliable.

DiGregorio testified that in reaching his conclusions, he followed normal methodology—"[t]he differential diagnosis you make with whatever information you have at the time." What Dr. DiGregorio was saying was that differential diagnosis is an ongoing process of making judgments about causation and then adapting those judgments as new information is acquired. He was asserting that even without examining the plaintiffs or conducting laboratory tests, he had sufficient information (his knowledge of plaintiffs' exposure to PCBs, his knowledge of the effects of PCBs, and the medical histories he took) to reliably conclude that PCBs were more likely than not a cause of plaintiffs' illnesses even after considering other possibilities.[28]

Put differently, we agree with the view of Drs. Sherman and DiGregorio that sometimes differential diagnosis can be reliable with less than full information, and, to the extent that the district court concluded otherwise, we hold that it abused its discretion. To provide a simplistic example, imagine a patient who comes in wtih medical records that include x-rays showing a fractured arm and who tells the doctor that he hurt the arm in a biking accident; the doctor could reliably conclude that the patient had a fractured arm caused by a biking accident even without physically examining the patient or taking a medical history.[29] The biking accident is so much more likely to have been the cause of the fracture than anything

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[28] Similarly, Dr. Sherman stated that her methodology was reliable because she looked at medical records, which contained the results of physical exams performed by other physicians (and medical histories taken by other physicians) A. 5103, at illnesses across the population, and then applied the medical literature to narrow down the cause (A5097, 5099).

[29] Just as a doctor can sometimes reach a reliable differential diagnosis without performing a physical examination, there may also be circumstances in which a doctor conducts a physical examination but this is insufficient to create a reliable differential diagnosis in the absence of the additional data.

else that there is no need to examine alternatives. *See Peteet v. Dow Chemical Co.*, 868 F.2d 1428, 1431-32 (5th Cir.), *cert. denied*, 493 U.S. 935, 110 S. Ct. 328 (1989) (allowing a doctor to testify as to causation based on an examination of medical records, of the plaintiff's deposition, and of the medical literature).[30]

In light of the foregoing discussion, we conclude that where Dr. Sherman or DiGregorio offered an opinion as to the source of a party's illness, the district court abused its discretion in excluding that opinion under Rule 702 unless either (1) Dr. Sherman or DiGregorio engaged in very few standard diagnostic techniques by which doctors normally rule out alternative causes *and* the doctor offered no good explanation as to why his or her conclusion remained reliable, or (2) the defendants pointed to some likely cause of the plaintiff's illness other than the defendants' actions and Dr. Sherman or DiGregorio offered no reasonable explanation as to why he or she still believed that the defendants' actions were a substantial factor in bringing about that illness.

In response, of course, the doctor could offer an explanation based on the plaintiffs' medical history, laboratory tests or any other reliable source.[31] *Cf. Cantrell v. GAF*

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[30] We note that it is not only simple cases that could justify a finding of reliability absent employment of a significant number of diagnostic techniques. Imagine a patient who comes to a physician with medical records demonstrating illness A known to be strongly associated with chemical X and evidence of exposure to that chemical. Also, imagine that there are other chemicals, foods, or other substances to which the patient has been exposed which sometimes, though much less frequently, cause this same illness. With a basic understanding of probabilities, a physician might very well be able to reliably conclude that a person exposed to chemical X was more likely than not to have contracted illness A as a result of that exposure than as a result of any other cause.

[31] (Plaintiffs argue that the test for admissibility of Dr. Sherman's testimony should be even lower, because of the "substantial factor" standard of causation for tort law in Pennsylvania. *See*

Corp., 999 F.2d 1007, 1012-13 (6th Cir. 1993) (applying *Daubert* to uphold the admissibility of the testimony of a doctor that asbestos had caused the plaintiffs'

Hamil v. Bashline, 392 A.2d 1280, 1284 (Pa. 1978). Under this standard, a plaintiff "need not exclude every possible explanation of the [injury]; it is enough that reasonable minds are able to conclude that the preponderance of the evidence shows defendant's conduct to have been a substantial cause of the harm to plaintiff." *Id.* at 1285. Thus, plaintiffs assert. Dr. Sherman and Dr. DiGregorio did not have to rule out alternative causes; they merely had to establish that PCBs were a substantial factor in plaintiffs illnesses.

We agree with the plaintiffs that because we are analyzing reliability for the purposes of litigation not for purposes of science, the substantive standard of causation can affect the standard of admissibility. However, we do not think that the "substantial factor" standard lowers the burden of admissibility here. The substantial factor test applies when a number of different factors each contribute to a particular result; "if two forces are actively operating, one because of the actor's negligence, the other not because of any misconduct on his part, and each of itself is sufficient to bring about harm to another, the actor's negligence may be found to be a substantial factor in bringing it about." Restatement 2d of Torts § 432. Where defendant's actions and other actions each contribute to harm to a plaintiff, for example, when a sick plaintiff dies after medical malpractice by defendant that might have saved her, "defendant is legally liable unless it can be shown that death would have resulted regardless of the action or inaction of defendant." *Hamil*, 392 A.2d at 1286.

Here, however, if plaintiffs' experts failed to rule out alternative causes, it means that these alternative causes may have been the sole causes of plaintiffs' injuries—PCBs may not have played any role at all and certainly may not have been sufficient to bring about the plaintiffs' injuries. Testimony that PCBs increased the risk that plaintiffs would contract the injuries that they contracted does not show that PCBs were a substantial factor in those injuries. Moreover, testimony that plaintiffs' exposure to PCBs makes it likely that PCBs were a substantial factor in plaintiffs' injuries cannot reliably establish that PCBs were in fact a substantial factor unless the expert thought about the possibility that other potential causes of those injuries were in fact the *sole* cause of those injuries. Even under the substantial factor test, plaintiffs must prove that defendants' actions *were* a cause of plaintiffs'

laryngeal cancer based on the unusually high incidence of this cancer among the plant workers despite the fact that the defendants had pointed to smoking as a possible alternative cause of the cancer). Thus, to avoid exclusion of his or her opinion, Dr. Sherman or DiGregorio did not have to conduct every possible test to assess whether his or her view was correct so long as he or she employed sufficient diagnostic techniques to have good grounds for

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injuries before the burden switches to defendant to show that the injuries would have occurred even absent any action by the defendant. *See Arnold v. Loose*, 352 F.2d 959 (3d Cir. 1965) (Pennsylvania law precludes an expert from testifying based on guess or conjecture, thus, the district court properly excluded a doctor's opinion that an individual lapsed into a diabetic coma before an accident when the doctor failed to rule out the alternative possibility that the brain injury suffered during the accident caused the coma).

The plaintiffs do cite several cases that hold that where plaintiffs present expert testimony that "defendant's conduct did, with a reasonable degree of medical certainty, increase the risk that the harm sustained by plaintiff would occur," it creates a triable issue of fact for the jury as to whether defendant's actions were a substantial factor." *Hamil*, 392 A.2d at 1289. But, even if this is a substantive rule of law rather than a procedural rule and thus applies in federal court, almost all of the cases articulating this rule are medical malpractice cases in which it is clear that defendant's actions were *a* contributing factor to plaintiff's injuries; moreover, these cases specifically rely on Restatement Second of Torts § 323(a), on the negligent performance of undertaking to render services, which they hold "relax[es] the degree of certitude normally required of plaintiff's evidence in order to make a case for the jury." *Id.* at 1286; *see also Gradel v. Inouye*, 421 A.2d 674, 677 (Pa. 1980) (squib), *Jones v. Montefiore Hospital*, 431 A.2d 920, 923 923 (Pa. 1981) (squib). Plaintiffs only cite one case outside the context of § 323(a) and it is a Pennsylvania Superior Court case which does not explain why it is applying *Harnil* as it does. *See Pirches v. General Accident Ins. Co.*, 511 A.2d 1349, 1351-52 (Pa. Super. 1986). We do not think that this latter case articulates the law in Pennsylvania, and we thus think that Pennsylvania substantive law does not change the federal standard for the admissibility of expert testimony.

his or her conclusion that the plaintiff's illness was caused by PCBs.

The conclusion that the opinion of a doctor who has engaged in few standard diagnostic techniques should be excluded unless the doctor offers a good justification for his or her conclusion is supported by the case law. *Cf. In re Agent Orange Product Liability Litigation*, 611 F.Supp. 1223, 1234-38, 1246-47 (E.D.N.Y. 1985) (excluding testimony by a doctor, based on his evaluation of form statements signed by the plaintiffs in which they indicated that they had been exposed to Agent Orange and then checked off their symptoms, that Agent Orange had caused plaintiffs' injuries at least absent evidence of an alternative cause); *Arnold v. Loose*, 352 F.2d 959 (3d Cir. 1965) (holding that Pennsylvania law precludes an expert from testifying based on guess or conjecture, and thus that the district court had properly excluded a doctor's opinion that an individual had lapsed into a diabetic coma before an accident when the doctor had failed to rule out the alternative possibility that the brain injury suffered during the accident had caused the coma); *Viterbo v. Dow Chemical Co.*, 826 F.2d 420 (5th Cir. 1987) (excluding doctor's testimony that the defendant had caused plaintiff's illness, because the doctor had relied on a medical history that omitted important information, the doctor had admitted the ailments could have a number of causes, and there was no good evidence that the defendant had caused these types of illnesses).[32]

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[32] The *Viterbo* court concluded:

> We do not hold, of course, that admissibility of an expert opinion depends upon the expert disproving or discrediting every possible cause other than the one espoused by him. Here, however, Dr. Johnson has admitted that Viterbo's symptoms could have numerous causes and, without support save Viterbo's oral history, simply picks the cause that is most advantageous to Viterbo's claim. Indeed, Dr. Johnson's testimony is no more than Viterbo's testimony dressed up and sanctified as the opinion of an expert. Without more than credentials and a sub-

We acknowledge that some of these cases can be read to indicate that an expert's opinion on causation should *always* be excluded absent employment of standard diagnostic techniques to rule out alternative causes. *See also Carroll v. Litton Systems, Inc.*, 1990 U.S. Dist. LEXIS 16833, *49, 53, 55 (W.D.N.C. 1990) (excluding testimony of medical doctors where they failed to employ differential diagnosis and rule out alternative causes). However, for the reasons explained above, we think that there will be some cases in which a physician can offer a reliable differential diagnosis without examining the patient, looking at medical records, taking a medical history, and performing laboratory tests.

We also think that the view of defendants' experts that a physical examination and review of medical records are integral parts of differential diagnosis is not based solely on their claim that these diagnostic techniques are necessary to assess causation but also on a view that these techniques are necessary to determine what illness a patient has contracted in the first place. In *In re "Agent Orange"*, 611 F.Supp. at 1246 (E.D.N.Y. 1985), Judge Weinstein faced a similar situation. In the end, he excluded a doctor's testimony as to causation, where the evidence of the patient's illnesses stemmed solely from a checklist they had filled out. He explained, "here we have statements of problems ranging from baldness to the most serious cancers . . . . While courts allow reliance on patient statements, they are based upon a personal history corroborated by medical records, a physical examination and medical tests." *Id.* He added, "[h]ere, the usual inducement to candor with a physician—the hope of successful treatment or diagnosis—was wholly lacking. *Cf.* Fed. R. Evid. 803(4). Instead, plaintiffs had every in-

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jective opinion, an expert's testimony that 'it is so' is not admissible."

Id. at 424.

centive to be overinclusive in describing their symptoms . . . ." *Id.*

Judge Weinstein was correct. We do not doubt the propriety of a medical report prepared just for litigation purposes, but a physician who evaluates a patient in preparation for litigation should seek more than a patient's self-report of symptoms or illness and hence should either examine the patient or review the patient's medical records simply in order to determine that a patient is ill and what illness the patient has contracted. Thus, we are satisfied that where Drs. DiGregorio or Sherman based their conclusion as to a plaintiff's symptoms solely on the plaintiff's self-report of illness in preparation for litigation, the district court acted within its discretion in excluding the testimony as based on an unreliable source of information.

On the other hand, we think that evaluation of the patient's medical records, like performance of a physical examination, is a reliable method of concluding that a patient is ill even in the absence of a physical examination. It is hornbook law that medical records are admissible for such a purpose—"[a]s to hearsay *symptoms told by third persons*, . . ., where the information is that of an *attending nurse* or *physician* having personal observation and an interest in learning and describing accurately, there seems to be every reason for admitting testimony based in part on this." 3 John Henry Wigmore, *Wigmore on Evidence* § 688(4) (Chadbourn ed. 1970). *See also Cohen v. Albert Einstein Medical Ctr.*, 592 A.2d 720 (Pa. Super. 1991) (holding that the testimony of a doctor who relied on medical records without conducting a physical exam was admissible proof that the plaintiff suffered from a psychiatric disorder); *Peteet v. Dow Chemical Co.*, 868 F.2d 1428, 1432 (5th Cir. 1989) (allowing testimony of a doctor who had not physically examined the plaintiff and noting that, "[a] personal examination of the person or object of the expert's testimony is not required under Fed. R. Evid. 703"). Hence, we think that generally, a

doctor only needs one reliable source of information showing that the plaintiff is ill and either a physical examination or medical records will suffice—but the doctor does need at least one of these sources.

Moreover, as we explained above, in order to establish causation sufficiently reliable for us to overturn the district court's decision as an abuse of discretion, where Drs. Sherman or DiGregorio engaged in few of the standard procedures of differential diagnosis, they had to offer a good explanation as to why their conclusion remained reliable. Where they did employ such standard techniques, they still had to offer such an explanation if the defendants pointed to some likely cause of the plaintiff's illness other than the defendants' actions.

We now apply these principles to the opinions of Drs. DiGregorio and Sherman regarding particular plaintiffs.

a. The opinion of Dr. DiGregorio

As we have noted, Dr. DiGregorio did not examine the plaintiffs or review their medical records; he simply relied on their answers to a questionnaire he gave them. Under the rule we have articulated above, *see supra* pp. 82-83. Dr. DiGregorio could not even reliably conclude that the plaintiffs had any illness. In fact, Dr. DiGregorio admitted that without examining the plaintiffs he could not state to a reasonable degree of medical certainty that they had been injured as a result of exposure to PCBs. We now uphold the district court's decision to exclude his testimony as within that court's discretion. Dr. DiGregorio simply lacked the foundation to make the judgments he did. For that reason alone, the district court was correct to grant summary judgment against the Hanes plaintiffs on their personal injury claims.

Moreover, inasmuch as he did not engage in standard diagnostic techniques, we presume that Dr. DiGregorio's

conclusions as to causation were unreliable unless he offered good grounds for concluding that they were correct. *See supra* pp. 79-80. But Dr. DiGregorio stated that his preliminary assumption was that *all* of the plaintiffs' injuries that they checked off in the questionnaire were caused by PCBs, and he did not explain what justified this assumption. For example, Dr. DiGregorio testified that PCBs caused Cathlene Brown's bruising but admitted that the birth control pills she took could also have caused the bruising. He explained that in order to confirm his diagnosis he would have to "investigate with her when did she start the bruising, how long has she been bruising, does she have any bruising now, and how long has she been on the contraceptives," but noted that his diagnosis would remain unchanged until he could conduct this investigation. Dr. DiGregorio nonetheless provided no reason to explain why he thought that PCBs were more likely to have caused Brown's bruising than contraceptives.[33]

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[33] Dr. DiGregorio's differential diagnoses of the other Hanes plaintiffs suffer from the same problem. He testified that PCBs had caused Christopher Brown to have an abnormal liver function test which he suggested was a sign that something was wrong with the liver. JA 6579. But he admitted that viruses, alcohol and drugs all could cause an abnormal liver function test and that he had not yet conducted the analysis necessary to rule out these possibilities. He stated that, as his working diagnosis, he believed PCBs were the cause because, "[h]e has an elevated PCB level and he has an abnormal liver condition. And as far as I'm concerned that's the number one differential." JA 2991. Yet Dr. DiGregorio did not indicate why he thought PCBs were the "number one differential."

With respect to Craig Brown's elevated L.D.H. enzyme test. Dr. DiGregorio was asked whether it would affect his opinion that PCBs had caused this elevation if he were told that Brown's medical records indicated that he drank a few cans of beer every work night and two to three six packs on Thursday, Friday, and Saturday nights. JA 2843-45. He replied that it would not unless he looked at the charts showing the effect of alcohol on the liver by quantity of alcohol and size and age of the person. JA 2845. But again Dr. DiGregorio offered no explanation as to why he con-

His analysis of other Hanes plaintiffs was similarly flawed, as explained in the margin.

Presumably, Dr. DiGregorio's general reasoning was that all of the plaintiffs had significant exposure to PCBs, that PCBs are a known cause of the illnesses of the various plaintiffs, and that, in the absence of any indication that any plaintiff had been exposed to something more likely to cause his or her illness than PCBs, it was reasonable to conclude that PCBs were a likely cause. But Dr. DiGregorio did not point to any evidence showing that PCB exposure was so likely to produce the type of illnesses the plaintiffs had in comparison to other possible causes to which plaintiffs had likely been exposed that it was reliable to conclude that PCBs were the cause without further analysis. We think that the district court essentially, and properly, read Dr. DiGregorio's testimony as showing that his opinion that PCBs caused plaintiffs' illnesses was only a hypothesis which he had yet to attempt to verify or disprove by subjecting it to the rigors of scientific testing. Thus, the district court properly excluded Dr. DiGregorio's testimony with respect to the Hanes plaintiffs'

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tinued to stick to his opinion. Dr. DiGregorio also opined that Mary Retta Johnson was anemic, as indicated by her blood test results, and that this anemia was caused by PCB exposure. He maintained this conclusion despite admitting that there were many other potential causes for anemia including bleeding, cancer, and a decrease of bone marrow function and stating that all would have to be investigated. JA 2966.

Finally, Dr. DiGregorio asserted that Curtis Brown's insomnia and elevated triglycerides were caused by PCB exposure. He conceded that there were many possible causes of insomnia and elevated triglycerides (he said the major cause of the latter was diet) but stated that he had to base his diagnosis on the information he had available at the time. JA 2880-81, 2895-97. He did not gather any information on these alternative possibilities; he did not even ask about Curtis Brown's diet. JA 2895-97. The other Hanes plaintiffs do not claim any present physical injuries as a result of PCB exposure.

personal injury claims and correctly granted summary judgment against them on these claims.

b. The opinion of Dr. Sherman

Unlike Dr. DiGregorio, Dr. Sherman reviewed the medical records of all of the plaintiffs on whose behalf she testified (the Kohn/Klehr plaintiffs). Moreover, she physically examined two plaintiffs (and took their medical history). Thus, she had a reliable source of information that each of the plaintiffs were actually ill. Dr. Sherman also had information on the history of PCBs in the Paoli area, the level of PCBs in plaintiffs' soil, some evidence of the level in their blood (for many plaintiffs), and the medical histories of the plaintiffs that were contained in their medical records. Nonetheless, with respect to those plaintiffs whom Dr. Sherman did not examine, she had little, if any data with which to rule out alternative causes of their illnesses. She did not take medical histories herself, there is no evidence in the record showing the extent to which medical histories were present in the plaintiffs' medical records, and she performed no reliable laboratory tests.

The district court excluded Dr. Sherman's testimony as a whole, on the grounds that her testimony demonstrated that she *never* considered alternative causes and *always* found PCBs to be the cause. If the district court was correct, then we would likely uphold its exclusion even if the defendants did not point to specific alternative causes that Dr. Sherman failed to consider for those plaintiffs whom she did examine. Given the number of plaintiffs in this case, we think that if there were no evidence that Dr. Sherman ever considered alternative causes, it would be reasonable for the district court to have presumed that she did not consider alternative causes even for those plaintiffs whom she examined and for whom she had significant data about alternative possibilities.

However, as we read Dr. Sherman's testimony, when she said that she did not rule out other causes, that does

not necessarily mean that she failed to consider them, but rather only that she did not rule them out as a possible cause or a partial cause in combination with PCBs, which she concluded were *one* significant factor in plaintiffs' illnesses. More particularly, where defendants point to evidence that Dr. Sherman acknowledged failing to rule out alternative causes, Dr. Sherman was merely admitting that there might have been other causes while stating that PCBs were a significant cause.

Plaintiffs point to several instances in which Dr. Sherman specifically considered alternative causes. She specifically considered Charles Stanbach's smoking as a possible cause of his esophageal cancer before ruling it out based on when he had stopped smoking and the types of changes he had in his cells. Moreover, *she declined* to say with a reasonable degree of medical certainty that the redness around George Burrell's eyes had been caused by PCB exposure even though PCBs were associated with such redness in the literature—she explained that she could not rule out alternative causes. For similar reasons she refused to say that Priscilla Burrell's headaches were caused by PCBs, and she opined that Monica Hilton's skin reaction was caused by poison ivy rather than exposure to PCBs. Dr. Sherman further testified that she could not state with a reasonable degree of medical certainty that PCBs caused ringing in the ears even though three of the plaintiffs complained of such ringing.

In view of these facts, we will not uphold the district court's *blanket* exclusion of Dr. Sherman's testimony without examining her testimony concerning particular plaintiffs. Applying the *Daubert* analysis we conducted above. *see supra* at p. 78, unless Dr. Sherman presented a good explanation for why she could reasonably testify that the illnesses of the plaintiffs whom she did not examine were caused by PCBs, the district court was within its discretion in excluding Dr. Sherman's testimony. With respect to those plaintiffs whom Dr. Sherman did examine, we conclude that she employed a sufficient number of standard

diagnostic techniques that the district court should have presumed that her testimony was reliable. Thus, Dr. Sherman's testimony is admissible with respect to these plaintiffs unless the defendants pointed to particular potential alternative causes and she was unable to explain why she thought these alternatives had not caused the plaintiffs' illnesses. *See supra* at pp. 76-77. In analyzing the adequacy of Dr. Sherman's explanations, we will weigh in the balance Dr. Sherman's somewhat dubious expertise—a factor we have deemed important under the Supreme Court's flexible *Daubert* inquiry. *See supra* at 43-44.

Defendants also contend that even if Dr. Sherman's testimony is admissible, it is insufficient to allow plaintiffs to survive summary judgment. Because plaintiffs did not rule out alternative causes, defendants submit, her testimony cannot establish that defendants' PCBs more likely than not caused plaintiffs' injuries. We disagree, for assuming that Dr. Sherman's testimony is admissible, her assertion that PCBs caused plaintiffs' medical injuries is sufficient to establish a genuine issue of material fact on causation. However, for reasons we have explained *supra* pp. 59-60, defendants are correct that under Pennsylvania law they are entitled to summary judgment where Dr. Sherman refused to state her conclusions with a reasonable degree of medical certainty or its substantive equivalent, and for reasons we will explain *infra*, they are entitled to summary judgment where the illness to which Dr. Sherman attested was asymptomatic. *See infra* p. 128 & n. 51 (concluding as part of an analysis of Pennsylvania's law on medical monitoring, that Pennsylvania does not recognize a cause of action for physical changes which are asymptomatic). Thus, in analyzing Dr. Sherman's testimony with respect to the particular plaintiffs, we will affirm the district court's grant of summary judgment with respect to some of the plaintiffs' claims without reaching the issue of the reliability of Dr. Sherman's methodology.

i. Bessie Cunningham

Dr. Sherman examined Bessie Cunningham, took her medical history and reviewed her medical records. Sherman testified that PCBs significantly contributed to Cunningham's headaches, sinusitis, blurred vision, arthritis, hypertension, peripheral swelling (edema) and nerve damage, and hysterectomy following three pregnancy losses. However, defendants offer a number of reasons why Dr. Sherman's testimony is not admissible and we turn to these contentions now.

First, Dr. Sherman's view that PCBs cause headaches partly relied on studies of the Yusho victims, studies which the district court properly excluded under Rule 403. *See infra* p. 123. But the fact that these studies would be inadmissible as substantive evidence before a jury does not render them unreliable as a source of data for experts who are in better position to evaluate (and discount them), and we have not deemed them to be unreliable as a source of such data. *See infra* p. 123. Thus, we do not think that Dr. Sherman's reliance on this data renders her entire methodology as to the source of Bessie Cunningham's headaches unreliable. Nor did the defendants point to an alternative source of these headaches that Dr. Sherman failed to consider. Thus, defendants did not put forth a basis for excluding Dr. Sherman's testimony regarding these headaches.

Dr. Sherman also testified that PCBs caused Bessie Cunningham's arthritis/arthralgia. She stated that Cunningham probably had both arthritis and arthralgia and that, of the types of arthritis, Bessie Cunningham probably had osteoarthritis. Defendants submit that Dr. Sherman's testimony is fatally inconsistent insofar as she opined that the only known cause of osteoarthritis is wear and tear. But defendants did not ask Dr. Sherman why she concluded that PCBs caused Mrs. Cunningham's arthritis if the only known cause of osteoarthritis is wear and tear; nor did they ask her how she eliminated wear

and tear as a likely cause. They also did not ask about possible alternative causes of arthralgia. Thus, they did not establish a basis for excluding Dr. Sherman's testimony that PCBs caused Bessie Cunningham's arthritis/arthralgia.

Dr. Sherman also opined that PCBs caused Cunningham's hypertension by elevating her lipid levels or through some other mechanism. Although she acknowledged that tests did not show elevated lipid levels. she stated that the tests were not necessarily an accurate indicator because lipid levels change rapidly and added that the PCBs might have caused the hypertension through a mechanism other than raised lipid levels. In any case, we have no reason to believe that, for differential diagnosis to be a reliable methodology, all of the data a doctor acquires must point to the same conclusion. The lipid tests were unreliable at all events, *see supra* p. 68, and thus we do not think that the fact that the lipid tests failed to support Dr. Sherman's conclusions inherently renders those conclusions unreliable. Finally, defendants did not point to any alternative causes of Cunningham's hypertension that Dr. Sherman failed to rule out. Thus, we think that her testimony that PCBs caused Bessie Cunningham's hypertension should not have been excluded.

Although Dr. Sherman initially testified that PCBs contributed to Mrs. Cunningham's pregnancy losses and caused her to have a hysterectomy, she later opined that PCBs were only a possible cause. She admitted she did not know the circumstances of Mrs. Cunningham's hysterectomy; nor did she know when Mrs. Cunningham's miscarriages had occurred in relationship to the time that PCBs began to be used at Paoli. Thus, when defendants pointed to possible alternative causes, Dr. Sherman could provide no justification for her elimination of these alternative causes thus rendering her testimony inadmissible. Even if her testimony were admissible, Dr. Sherman's statement that PCB's were a possible cause did not have sufficient scientific certainty to survive summary judgment. *See Schulz*, 942 F.2d at 208, *supra* p. 58.

Dr. Sherman's entire testimony explaining her conclusion that PCBs caused Mrs. Cunningham's sinusitis was as follows:

> I said that I thought that the chronic exposure to PCBs, dibenzofurans, dioxins and the associated chemicals from the Paoli yard interfered with her immune function, and secondarily, she had long time multiple complaints with respiratory upper respiratory problems. I think it's a fact. I don't think it's the sole cause.

This testimony seems to place heavy reliance on the unreliable immunological data, *see supra* p. 68, and therefore we hold that the district court acted within its discretion in concluding that Dr. Sherman's entire methodology with respect to Bessie Cunningham's sinusitis was unreliable and thus inadmissible.

In sum, we conclude that while the district court properly excluded Dr. Sherman's testimony with respect to Bessie Cunningham's pregnancy losses, hysterectomy, and sinusitis, the court abused its discretion in excluding Dr. Sherman's testimony that PCBs caused Cunningham's headaches, arthritis/arthralgia and hypertension.

ii. Amber Burrell

Dr. Sherman examined Amber Burrell, took a medical history of her from Amber's mother, and reviewed Amber's medical records, Dr. Sherman concluded that Amber's skin reactions were prodromes of chloracne caused by exposure to PCBs, and that Amber's recurring respiratory ailments and infections, immune system damage, and absence of appropriate ankle reflexes were also caused by exposure to PCBs.

The defendants' experts pointed to a possible alternative cause of Amber's respiratory ailments and infection, suggesting that these ailments might have been normal childhood problems. But Dr. Sherman testified that, although

she did not know whether Amber had contracted more respiratory infections than most children, the unusual nature of Amber's skin abnormalities and premature breast development combined with Amber's elevated leukocyte counts shown in hospital records and current immunological tests and with the fact that Amber's infections largely went away when she moved away from Paoli, demonstrated that PCBs had caused Amber's respiratory ailments and infections.

Hence, when asked about a possible alternative cause, Dr. Sherman pointed to a variety of data as justification for her conclusion that PCBs had caused Amber's respiratory infections. Regardless of whether Dr. Sherman's conclusion was correct, her methodology was reasonably reliable. Although part of Dr. Sherman's differential diagnosis relied on current immunological tests that the district court excluded as unreliable, this was only a small part of the basis for her opinion. Thus, the district court abused its discretion in excluding Dr. Sherman's testimony regarding Amber's respiratory ailments.

Dr. Sherman also testified that PCBs caused Amber's skin abnormalities which she asserted were prodromes of chloracne. She stated that the only reason Amber did not develop full blown chloracne was that she moved away from Paoli. But the defendants showed that Amber's skin condition might have been normal teenage acne with no relationship to PCBs. Dr. Sherman offered no explanation as to why she eliminated this possibility—at least no explanation reliable enough to be helpful to the jury. Dr. Sherman admitted she was not an expert in dermatology, and she demonstrated little knowledge about chloracne. She incorrectly testified that "we don't know whether ordinary teenage acne isn't really chloracne." *See supra* p. 63. Moreover, she acknowledged that she was not sure if she had ever seen acne on anyone who had not been exposed to PCBs, and opined that the only way to determine whether a patient's acne was caused by PCBs was to do a history of their exposure to PCBs (presumably,

if the patient had been exposed to PCBs then ipso facto his or her acne was caused by PCBs). This suggests that Dr. Sherman made no effort to employ differential diagnosis to eliminate possible alternative causes of Amber's skin abnormalities; we therefore uphold the district court's determination that Dr. Sherman's testimony on Amber's skin condition was inadmissible.[34]

Dr. Sherman also testified that PCBs were a significant factor in Amber's reduced ankle reflexes. However, she was not willing to answer yes or no to the question whether she could say this with a reasonable degree of medical certainty. Thus, the district court properly granted summary judgment on this claim regardless of whether Dr. Sherman's testimony was admissible. *See supra* pp. 62-63.

In sum, the district court properly excluded Dr. Sherman's testimony regarding Amber Burrell's skin condition and granted summary judgment on her claim regarding ankle reflexes, but abused its discretion in excluding her testimony regarding Amber's respiratory ailments.

iii. Priscilla Burrell

Dr. Sherman did not examine any plaintiffs other than Bessie Cunningham or Amber Burrell, nor did she take their medical histories. The district court properly excluded Dr. Sherman's testimony with respect to all of these plaintiffs because she did not advance a reliable explanation as to why she ruled out alternative causes with respect to any of them. We will delineate Dr. Sherman's failure to offer such an explanation beginning with her testimony regarding Priscilla Burrell.

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[34] Dr. Sherman also testified that Amber's treating physician thought that PCBs "could be a factor . . . in this child's skin reaction and her illness." (JA 868). But this tentative opinion, even if it constituted data reasonably relied upon by an expert, was not rendered with a sufficient degree of assurance for Amber to avoid summary judgment on this claim.

Dr. Sherman did not examine Priscilla Burrell, nor did she take her medical history. She did talk to Priscilla Burrell and reviewed her medical records formulated by doctors who had examined her. Based on these medical records, Dr. Sherman testified that Priscilla Burrell suffered skin problems, two pregnancy losses, dizziness, ringing in her ears, and kidney damage, all as a result of her exposure to PCBs. Subsequent to Dr. Sherman's deposition and entry of a district court order that she should not supplement her expert report, the thirty-three year old Mrs. Burrell was diagnosed as having kidney cancer.

Dr. Sherman's assessment of the cause of Priscilla Burrell's skin problems suffers from the same methodological flaws as her opinion with respect to Amber's skin problems. Similarly, in linking PCBs to Priscilla Burrell's pregnancy losses, Dr. Sherman failed even to ascertain whether these losses had been due to optional abortions. With respect to dizziness, Dr. Sherman testified that infections cause dizziness and that she was unable to state whether they had done so here. Dr. Sherman took no steps that might have allowed her to conclude that PCBs rather than infections caused Mrs. Burrell's dizziness. Thus, she did not offer any explanation as to why she had eliminated even the most obvious possible alternative causes of skin problems, pregnancy losses or dizziness.

Dr. Sherman also testified that PCBs caused kidney damage which resulted in the blood in Mrs. Burrell's urine. But the only basis for Dr. Sherman's belief that there even was blood in Mrs. Burrell's urine was a conversation with Martin D'Urso, plaintiffs' counsel. Dr. Sherman did not examine Mrs. Burrell's medical records with respect to this problem and thus, did not have a reliable basis for concluding that Burrell had kidney problems much less that those problems were caused by PCBs. Dr. Sherman offered no explanation as to what alternative causes she considered for Mrs. Burrell's kidney problems or how she ruled them out. Thus, Dr. Sherman's testimony regarding

Priscilla Burrell's injuries was unreliable and hence inadmissible.

Plaintiffs made no effort to ask the district court to allow Dr. Sherman to supplement her opinion in light of the new diagnosis of kidney cancer, nor did they offer the opinion of Mrs. Burrell's treating physician in opposition to summary judgment. Because plaintiffs presented no admissible evidence on Priscilla Burrell's personal injury claims, the district court properly granted summary judgment for the defendants on these claims.

iv. Monica Hilton

Dr. Sherman did not examine Monica Hilton. She opined that PCBs contributed to Monica Hilton's susceptibility to cough and respiratory problems and to her (related) augmented immune response. But Dr. Sherman failed to explain why she thought that PCBs were a cause of these problems in light of possible alternative causes. Thus, the district court properly excluded Dr. Sherman's testimony with respect to Monica Hilton and granted summary judgment against her on her personal injury claims.

v. Matthew Cunningham

Dr. Sherman did not examine Matthew Cunningham but nonetheless testified that PCBs caused his heart disease including hypertension, aortic sclerosis, myocardial infarction and ultimately his death. She also averred that PCBs caused Cunningham's liver damage.

Dr. Sherman theorized that PCBs caused Mr. Cunningham's heart disease either by elevating his cholesterol and triglyceride fractions or by directly affecting his tissues. While she later admitted that she was not sure whether these two mechanisms were distinct and that there were no tests showing an elevation of cholesterol levels, she pointed out that there was a test showing elevated triglyceride levels. But the district court properly excluded this test as unreliable. *See supra* pp. 67-68. Absent reli-

ance on this data, Dr. Sherman expressed no reason for her conclusion that PCBs caused Cunningham's heart disease nor why she had ruled out the possibility of alternative causes for this disease. Thus, the district court acted within its discretion in excluding her opinion.

While Dr. Sherman admitted that hereditary factors may have increased Mr. Cunningham's risk of contracting hypertension, she did not withdraw her opinion that PCBs were a significant factor in his developing hypertension and other forms of heart disease. But once again she failed to explain why she thought that PCBs rather than alternative causes were responsible and thus the district court properly excluded her testimony.

Dr. Sherman also asserted that PCBs caused Mr. Cunningham's cellular liver damage, but there was no evidence indicating that that damage had any symptoms. Thus, the district court properly granted summary judgment on the claim of liver damage because the damage was asymptomatic, *see infra* p. 128 & n. 51, and on the claims of hypertension and heart disease because Dr. Sherman's causation opinion with respect to these diseases was inadmissible.

vi. Patricia Ingram

Dr. Sherman did not examine Patricia Ingram but did review her medical records. She testified that PCBs were a significant factor in Patricia Ingram's chronic obstructive pulmonary disease and asthma, and her increased cellularity. She added that the steroids that Patricia Ingram took for her asthma caused her diabetes and therefore that PCBs indirectly caused that diabetes. But she could not testify with a reasonable degree of medical certainty as to the particular mechanism by which PCBs caused the asthma and ultimately the diabetes.

Dr. Sherman conceded that she had not ruled out possible alternative causes of Patricia Ingram's asthma,

although this may have just meant that she had not *completely* eliminated that these alternatives as causal agents. Yet this testimony, when considered in the light of Dr. Sherman's limited expertise about asthma show that her methodology in evaluating the causation of Patricia Ingram's asthma was unreliable. This renders her methodology in relating PCBs to diabetes unreliable as well because her methodology depended on the fact that PCBs had caused Ingram's asthma. Moreover, Dr. Sherman acknowledged that she did not consider any possible causes of Patricia Ingram's diabetes other than her asthma treatment. As for increased cellularity, there is no indication that there are any symptoms associated with this condition and thus it cannot be the basis of a personal injury claim. *She infra* p. 128 & n. 51. Because Dr. Sherman's testimony on the cause of Patricia Ingram's illnesses is inadmisisble and because increased cellularity is asymptomatic, Patricia Ingram's personal injury claims cannot survive summary judgment.

vii. John Ingram, Sr.

Dr. Sherman did not examine John Ingram, Sr. but testified that PCBs caused his elevated triglycerides, augmented immune response and hypertension. The first two are asymptomatic and non-compensable. *See infra* at 128 & n. 51. As for hypertension, Dr. Sherman indicated that because she was working solely from medical records, she had not examined possible alternative causes. Therefore, Dr. Sherman's testimony on John Ingram, Sr.'s hypertension must be excluded as unreliable which means that John Ingram, Sr.'s personal injury claims cannot survive summary judgment.

viii. John Ingram, Jr.

Dr. Sherman reviewed John Ingram, Jr.'s medical records but did not examine him. She testified that PCBs caused a suppression of his immune system which signifi-

cantly contributed to his recurring respiratory infections. However, the only evidence Dr. Sherman cited for the proposition that John Ingram, Jr.'s immune system was in fact suppressed was the AAL immunological test results which are unreliable and inadmissible. *See supra* p. 68. Thus, Dr. Sherman's methodology for concluding that John Ingram, Jr.'s personal injuries were caused by PCBs is unreliable. As a result, her opinion is inadmissible and Ingram's personal injury claims cannot survive summary judgment.

ix. George Burrell

Dr. Sherman stated that George Burrell's headaches, dizziness, ringing in the ears, and eye irritations were compatible with the pattern of illnesses caused by PCBs but she did not state with a reasonable degree of medical certainty that PCBs caused Mr. Burrell's medical problems. Without sufficient evidence of causation, these claims cannot survive summary judgment.

x. Wallace Cummins

Dr. Sherman did not examine Wallace Cummins, nor did she read his medical records before submitting her expert report. By the time of the *in limine* hearing, however, Dr. Sherman had read Cummins' medical records and she listed Cummins' cancer as evidence for the proposition that Paoli residents had a higher incidence of kidney cancer than was present in the general population. However, she did not testify that PCBs caused Cummins' cancer. Therefore, her testimony, even if it were admissible, is insufficient to enable Cummins to survive summary judgment.

Plaintiffs represent that Cummins' treating physician, Dr. Stanley Glauser, will testify that PCBs caused Cummins' kidney cancer and his hypertension. However, while Cummins listed Dr. Glauser as a fact witness for trial, he did not submit his affidavit in opposition to summary

judgment. Indeed, the only reference to Dr. Glauser in the summary judgment record is an unsupported reference in plaintiffs' opposition brief to the deposition of Cummins' wife, who testified as to what another physician had told her that Dr. Glauser had told him about Cummins' condition. Such hearsay testimony is insufficient to survive a motion for summary judgment. Fed. R. Civ. P. 56(e). *See Fowle v. C & C Cola, Div. of ITT-Continental Baking Co.*, 868 F.2d 59, 67 (3d Cir. 1989); *Garside v. Osco Prag*, 895 F.2d 46, 50 (1st Cir. 1990).[35] Thus, Cummins' personal injury claims cannot survive summary judgment.

xi. April Ingram

Dr. Sherman testified that April Ingram had skin problems, but she did not testify that PCBs caused these problems. She did allege that PCBs caused April's immunological abnormalities but these are asymptomatic. *See infra* at 128 & n. 51. Thus, April Ingram's personal injury claims cannot survive summary judgment.

xii. The Remaining Plaintiffs

Dr. Sherman did not testify that PCBs caused illnesses of any of the other plaintiffs, including those seeking damages for personal injuries. For their personal injury claims, these plaintiffs relied on the testimony of the experts whose testimony the district court excluded for

[35] Because Dr. Glauser has become ill, plaintiffs have asked us for permission to substitute the testimony of Dr. Stephen C. Fox, another of Cummins' treating physicians. However, in order for plaintiffs to be allowed to substitute Dr. Fox for Dr. Glauser and to rely on his testimony to survive summary judgment, Dr. Glauser's opinion must have enabled plaintiffs to survive summary judgment in the first place. Otherwise, the plaintiffs would be adding new evidence on appeal in order to survive summary judgment. For the reasons explained in the text, we do not think that Dr. Glauser's opinion would have enabled plaintiffs to survive summary judgment and thus Dr. Fox's opinion is immaterial.

failure to comply with the court's pre-trial orders. But because the plaintiffs did not point to the testimony of these experts in their opposition to summary judgment, the testimony of these experts does not enable these plaintiffs to survive summary judgment. *See supra* pp. 37-38.

c. *Rule 403*

The district court also excluded Dr. Sherman's testimony under Rule 403, reasoning that the jury would give more probative weight to Dr. Sherman's testimony than it was entitled to, because Dr. Sherman simply attributed all illnesses to PCBs and was evasive on cross examination. This is not an appropriate Rule 403 rationale. We fail to see what characteristics of Dr. Sherman's testimony would make it the subject of the type of 403 balance necessary for its exclusion, such as that it is harder for the jury to evaluate this testimony than any other scientific testimony. *See Downing*, 753 F.2d at 1240. The 403 ruling will be reversed.

d. Summary (DiGregorio and Sherman)

In sum, we will uphold the district court's exclusion of Dr. DiGregorio's testimony regarding causation of the Hanes plaintiffs' personal injuries as based on an unreliable methodology—he failed to examine the plaintiffs, review their medical records, or consider alternative causes of their illnesses. As a result we will affirm the district court's grant of summary judgment against the Hanes plaintiffs on these claims.

Similarly, we will uphold the district court's exclusion of Dr. Sherman's testimony regarding causation of the Kohn/Klehr plaintiffs' present injuries with the exception of the claims of Bessie Cunningham and Amber Burrell. With respect to most plaintiffs, the district court acted within its discretion in concluding that Dr. Sherman's methodology was unreliable. She failed to examine plain-

tiffs or take their medical histories and offered no good explanation as to why she concluded that PCBs were the cause of plaintiffs' illnesses. While we will reverse the district court's ruling that Dr. Sherman is not a qualified expert, we will uphold the court's decision that the immunological tests on the plaintiffs were not of the type reasonably relied on by experts.

However, we have concluded that the district court abused its discretion in excluding Dr. Sherman's testimony regarding some of the present illnesses of Bessie Cunningham and Amber Burrell—both of whom Dr. Sherman did examine and whose medical histories she took, and with respect to whom she performed an acceptable differential diagnosis. Their claims will survive summary judgment so long as the plaintiffs have presented sufficient admissible evidence of their exposure to PCBs and the harm caused by PCBs. We turn to those questions now.

VII. EXPOSURE—THE OPINION OF IAN C.T. NISBET, Ph.D.

The defendants submit that the plaintiffs' personal injury and medical monitoring claims cannot survive summary judgment because they cannot demonstrate that they were exposed to PCBs at levels above the background levels to which members of the general population are exposed.[36] Six plaintiffs (Bessie Cunningham, Matthew

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[36] We note that even if defendants are correct that plaintiffs can only demonstrate exposure at levels within background, this would not necessarily justify the grant of summary judgment for defendants. For example, if everyone in the population had been exposed to substantial amounts of defendants' PCBs such that each individual had high PCB levels, each individual would have PCB livels within the background but this would not justify a verdict for defendants. Normally, plaintiffs could not make out a viable claim if their exposure is within background levels because there would be no reason to believe that their exposure was from the defendants' PCBs as opposed to other PCBs. However, to the ex-

Cunningham, Amber Burrell, Priscilla Burrell, and Patricia Ingram), including the two who have potentially viable personal injury claims, relied on Dr. Ian C.T. Nisbet to demonstrate the "extent of their exposure to PCBs."[37] Dr. Nisbet has a Ph.D. in physics with a specialization in fluid mechanics. Although he has no formal education in toxicology, he has worked exclusively in the field of environmental sciences since 1968, and he has developed and worked on methods for assessing the way chemicals move in the environment and the risks they pose. In 1975, the EPA commissioned Dr. Nisbet to summarize and analyze studies on PCBs. The Electrical Power Research Institute has also commissioned Dr. Nisbet's organization to review PCB literature; indeed, two of the defendants' experts, Drs. Whysner and Chase, were subcontractors on the study. In 1991, the Agency for Toxic Substances and Disease Registry selected Dr. Nisbet as one of three peer reviewers for a toxicological profile on PCBs. Dr. Nisbet has also been involved in six or seven litigated cases involving PCBs—half for plaintiffs, half for defendants. Thus, Dr. Nisbet is a well qualified expert.

Dr. Nisbet began his assessment of plaintiffs' exposure to PCBs by evaluating the history of PCBs at Paoli. He reviewed the plaintiffs' medical records and employment records and the use of PCBs at the Yard, including the increasing concern at the Yard about the potential harm of PCBs and the safety measures taken as a result. He looked at Monsanto's escalating warnings to its customers

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tent that the plaintiffs can demonstrate that their exposure stemmed from the *defendants'* PCBs, they will have presented evidence sufficient to survive summary judgment even if their exposure was within background levels—so long as this exposure was sufficient to result in their illnesses.

[37] We cannot separate out the evidence Dr. Nisbet presented regarding the exposure of each of the six plaintiffs because neither side has pointed us to such evidence.

about PCB risks, increasing federal actions on PCBs, improved housekeeping measures by defendant railroads in the early 1980s, emergency measures taken by EPA in the mid 1980s to reduce runoff from the Paoli Railyard, and statements from plaintiffs about steps they took to decrease exposure to PCBs after being warned in 1986. From this information, he concluded that plaintiffs' exposure to PCBs was greatest before 1986.

Dr. Nisbet combined this general assessment of plaintiffs' history of exposure to PCBs with three methods of calculating actual PCB levels: (1) recalculation of blood tests taken by the American Medical Laboratories ("AML"), (2) recalculation of background levels of PCBs, and (3) back calculations of PCB levels in 1986 based on the decay rate of PCBs. The district court held all three methods to be unreliable. We agree with the district court with respect to the first and third methods described below, but conclude that the district court erred in finding Dr. Nisbet's second method unreliable and that it abused its discretion in excluding this opinion.

A. Recalculation of the AML Data

Dr. Nisbet first relied on a recalculation of results of blood tests for PCBs taken by the American Medical Laboratories, Inc. and National Medical Services ("NMS") in 1986 and in 1987. These tests originally showed that plaintiffs' PCB blood levels fell within the general population background PCB levels reported by the laboratory. However, Dr. Nisbet concluded that these tests were inaccurate because the laboratory manager of AML advised him that lab practices in 1986 and 1987 had become sloppy. This was in turn because: (1) AML had used the packed column method, an ostensibly obsolete method of PCB assessment; (2) AML no longer had back up data and had not analyzed samples until a month after they were collected; (3) AML had analyzed blood serum instead of plasma which understates PCB concentrations; and (4) AML's chromatogram showed a PCB pat-

tern that was not consistent with any of the PCB transformer fluids (Aroclors) in the Yard.

Because AML results were two and a half to three times lower than Michigan State Laboratory results for *three unrelated samples in March of 1986* and because Dr. Nisbet thought Michigan State's laboratory was more reliable than AML, he concluded that AML results were generally too low by a factor of two and a half to three. (N 158, 164-68). He therefore *recalculated AML* tests for plaintiffs from August of 1987 by multiplying them by two and a half to three. After such recalculation, the level of PCBs ostensibly present in plaintiffs' blood became far more than background. Defendants challenge this methodology.

The district court found that many of the factual bases from which Dr. Nisbet determined that AML results were inaccurate were themselves inaccurate. It found that the packed column method AML used to assess PCBs was better known than the alternative, that AML did have back up data that Dr. Nisbet could have attained and evaluated, and that AML analyzed the samples a mere two weeks after they were collected. Moreover, tests of AML procedures demonstrated that AML results were generally accurate. The court referenced the testimony of Dr. Whysner who explained that AML had produced results the EPA had found acceptable when EPA spiked samples with PCBs and sent them to AML for analysis in December of 1986; and that AML had produced accurate results for 30 samples sent to it by Washington Occupational Health Associates, Inc. from 1986-92. And, data provided to Dr. Nisbet at the *in limine* hearing (data obtained by Dr. Whysner from AML and Michigan State) demonstrated that the disagreement between AML results and Michigan State results was smaller than he had previously thought.[38]

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[38] Dr. Nisbet admitted that new evidence indicated greater agreement between AML and Michigan State, but he contended that the

The district court went on to find that even assuming a large gap between AML and Michigan State results for the three samples and that the Michigan State results were more accurate, it was not scientifically valid to recalculate results for samples from one laboratory based on a comparison of two laboratories' analysis of three samples a year and a half earlier. Dr. Whysner stated that he had never seen an expert perform such a recalculation. In his view, the problems with this methodology were especially serious given the existence of data showing AML results to be generally accurate, and the existence of data showing that AML and Michigan had produced similar results for PCB samples sent to each laboratory in both October of 1987 and in 1989. Dr. Whysner also stated that there are a variety of explanations for the difference between AML and Michigan State results for the three samples sent in 1986, including the possibility that something happened to the samples during transit.

In light of this evidence the district court concluded that the recalculation rested on a novel scientific methodology that had not been identified in any literature and so had not been subject to critical scrutiny, that it was based on inaccurate assumptions, and ignored inter-laboratory comparison data. The court found that no reasonable scientist in the field of exposure assessment would perform such a calculation. As a result, the district court held Dr. Nisbet's testimony on this matter to be unreliable under Rule 702, and the reliance on the 1986 data from the three samples and the recalibrated 1987 AML results to be data not of the type reasonably relied upon by experts under Rule 703.

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new data showed disagreement between these labs and a third lab. However, disagreement with a third lab hardly provides a justification for multiplying AML results by a factor of two and a half to three. There is no evidence in the record about the extent of the disagreement with the third lab, nor is there evidence that the third lab was more accurate than AML and Michigan State.

We defer to the district court. Recalculation might be acceptable methodologically if there were a series of disagreements of two and a half to three times between two labs over a period of time. However, recalculation based on three samples does not appear reliable. Applying the *Daubert* factors, recalculation itself is not a technique identified in the scientific literature; nor is it generally accepted. To the extent it produces falsifiable results enabling scientists to test whether AML consistently understates its results by two and a half to three times, those results have in fact been falsified by data showing that AML and Michigan State generally produce similar results. And recalculation based on a comparison of three samples is likely often to lead to erroneous results. Although plaintiffs argue that because Dr. Nisbet himself admits that his recalculations are rough estimates he will not confuse the jury, we hold that under *Daubert*, the district court did not err in concluding that the recalculations Dr. Nisbet performed are too rough to be considered reliable at all. Thus, we uphold the district court's exclusion of these recalculations under Rules 702 and 703.

B. *Recalculation of Background*

Dr. Nisbet also believes that, because the background range used by AML was too high, AML results were above background even if the AML results were accurate. Dr. Nisbet opined that the 5 to 30 parts per billion background range used by AML was too high because it relied on studies of unrepresentative populations and because it assumed that the background range had not changed from 1950 to 1990. In reality, according to Dr. Nibet, the PCB background range had declined since 1970 as a result of regulatory efforts and voluntary efforts to reduce PCB use. Apparently, the few longtiudinal studies that have been performed agree that this decline has occurred. Dr. Sherman agreed with Dr. Nisbet that background levels of PCBs have dropped over time.

Rather than relying on the background levels used by AML, Dr. Nisbet decided that background use could best be measured by the National Human Adipose Tissue Survey (NHATS), a nation-wide study which appropriately showed declining PCBs in human fat samples from 1970 to 1983. (N 98-99, 142). However, Dr. Nisbet could not directly compare the NHATS data on the background levels of PCBs in *fat* to the AML data on levels of PCBs in plaintiffs' *blood*. Before attempting such a comparison, Dr. Nisbet had to convert background PCB levels in fat into their equivalent in blood by using a ratio of PCBs in blood in PCBs in fat.

However, the district court found that "experts in the field of exposure assessment do not reasonably rely upon NHATS fat data to calculate background PCB blood levels," and excluded the calculation under Rule 703. The court based its holding on the testimony of Dr. Whysner, who stated that he had never seen experts use NHATS fat data to calculate background levels in blood. Dr. Whysner testified that NHATS reported the background levels in fat in ranges because EPA did not think the data was accurate enough to give average levels; and if it was not accurate enough to give average levels it certainly was not accurate enough to use to convert into blood levels.

To the extent that Dr. Whysner's testimony was that PCB levels in fat could not be used to determine PCB levels in blood, plaintiffs adequately rebutted it. Plaintiffs cite several articles that convert PCB levels in fat to levels in blood (*see, e.g., Luotamo, et al. Assessment of Exposure to PCBs: Analysis of Selected Isomers in Blood and Adipose Tissue*, 54 Env. Reearch 121-34 (1991)) and represent that one of defendants' experts, Dr. Chase, made such a conversion in a 1984 trial at a rate which would lead one to conclude that plaintiffs' blood levels were well above background. It thus appears that the plaintiffs are correct that fat levels are a type of data often used by experts to calculate blood levels, and that

calculating blood levels from fat levels is a reliable methodology.

Dr. Whysner's testimony, however, also called into question whether the *NHATS* fat data is a type of data reasonably relied on by experts to perform such a calculation.[39] Defendants state that while Dr. Chase said that the fat to blood ratio of PCBs could be between 50 to 1 and 500 to 1, he did not say that any estimate was reliable enough to use, and he explicitly stated, like Dr. Whysner, that the NHATS data was not accurate enough to use as a starting point.

Because NHATS data is such a specific type of data, there is little evidence in the literature on whether experts reasonably rely on the particular data. Yet NHATS data is a subset of a type of data reasonably relied on by experts; and thus we are inclined to deem it reliable. *See supra* p. 42 & n. 8, 48 n. 14. Dr. Nisbet, an extremely well qualified expert, thought that NHATS data was a type of data reasonably relied upon, and he provided strong reasons why this data was at least as accurate a source of PCB background blood levels as other studies that analyzed PCB background blood levels directly. Indeed, defendants cite only one or perhaps two (depending on the meaning of Dr. Chase's deposition) experts who have contrary opinions on the reliability of NHATS fat data as a source of conversion to blood levels, and they provide no strong reasons why these experts should be

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[39] As a result, plaintiffs assert that the defendants are only arguing that experts would not reasonably rely on *this* data (NHATS data) as a basis of conversion to PCB blood levels not that experts would not reasonably rely on this *type* of data (fat data). The language of Rule 703 only precludes an expert from relying on *types* of data not reasonably relied on by experts; thus, plaintiffs contend, it was permissible for Dr. Nisbet to rely on NHATS data even if the particular data was imperfect. But we do not rest upon this difficult distinction, for defendants' argument is easily recharacterized as attacking expert reliance on fat data reported in broad ranges (a type of data) rather than as an attack on particular data.

believed as opposed to Dr. Nisbet. Although we review the district court's Rule 703 determination for abuse of discretion, after taking a hard look, the court's conclusion that the (converted) fat data is not reasonably relied upon does not survive the foregoing analysis. Aided by the preference for admissibility of such evidence under the rules, the NHATS data is reliable enough to prove helpful to the jury when converted into background blood levels, and it passes *Daubert* muster. The district court therefore abused its discretion on excluding it.

C. *Back Calculations*

Dr. Nisbet used a third method to calculate PCB exposure prior to 1986. He began with tests of the PCB levels of six plaintiffs in 1992 by the ELI Eco Logic Laboratories, Inc. (Eco Logic), a Canadian scientific consulting firm that performs original research. These tests showed levels of PCBs in plaintiffs' blood comparable to those provided by AML tests in 1986. However, because of precautions taken at the Yard since 1986 to decrease leakage of PCBs, Dr. Nisbet reasoned that plaintiffs' exposure to PCBs had declined since 1986. Thus, he assumed that plaintiffs must have had more PCBs in their blood in 1986 than they had in 1992. By using assumptions about the decay rate of PCBs combined with a model of plaintiffs' exposure to PCBs from non-yard sources, Dr. Nisbet calculated a range of plaintiffs' blood level of PCBs in 1986 from the level in their blood in 1992.

The district court excluded Dr. Nisbet's back calculations as an unreliable methodology for a variety of complicated reasons. One of its reasons was that it concluded under Rule 703, that the Eco Logic data, ostensibly showing the levels of PCBs in plaintiffs' blood in 1992 was a type of data not reasonably relied upon by experts. Because we think that the district court acted within its discretion in precluding Dr. Nisbet from relying on the Eco Logic tests, and that becomes dispositive, we do not

have to reach the issue of the validity of the methodology of performing back calculations.

The district court's Rule 703 ruling had several predicates. First, the court excluded the testimony of Richard Gierczak, plaintiffs' expert on the methodology used by Eco Logic, on the ground of lack of qualifications. It then precluded the admission of the Eco Logic results under Rules 702 and 703, finding that the methodological challenges raised by defense expert Dr. Peterson rendered the results unreliable and unhelpful to the jury. It also ruled that quality control problems rendered the data generated by Eco Logic not of the type reasonably relied on by experts. While the district court erred regarding Gierczak, in view of the balance of our analysis, we must affirm the exclusion of the evidence.

Plaintiffs offered the testimony of Gierczak to defend Eco Logic's methodology. Gierczak has a bachelor's degree and a master's of science degree in medical sciences from McMaster University in Hamilton, Ontario. He currently works as a Senior Project Chemist at Eco Logic. The district court disqualified Gierczak because the only analytic chemistry classes he had taken were as an undergraduate and the 1992 results were the first Gierczak had issued on the congener specific analysis of human blood for PCBs (a method of assessing quantities of specific types (congeners) of PCBs). But the court ignored Gierczak's uncontested testimony that he had been involved in analytic chemistry for "essentially six years. I would include in there graduate work as well, because it was chromatography." [40]

Although the Eco Logic report was the first one Gierczak had *written* on the congener specific analysis of human blood, he had analyzed approximately 50 samples using this method. It is uncontradicted that Gierczak had significant experience performing complicated lab tests,

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[40] Apparently, the only analytic chemistry *courses* Gierczak had taken were as an undergraduate (A 5706).

including the type performed here. Under these circumstances, the liberal qualification standards of Rule 702, *see supra* p. 40, are clearly met;[41] and the district court abused its discretion in ruling Gierczak unqualified. It appears, however, that despite its ruling, the district court considered Gierczak's testimony before concluding that the Eco Logic methodology was unreliable, and hence we turn to the methodological question.

The district court essentially based its conclusion to reject the Eco Logic data on the testimony of Dr. Peterson, who is the Director of Research and Development at Pacific Toxicology Labs in Los Angeles, where he has responsibility for technical matters. Dr. Peterson opined that Eco Logic's methodology was inadequate on several grounds. First, Eco Logic had failed to provide a written protocol describing in detail its method of performing the test (A. 5173). Although Eco Logic provided defendants a written description of the technique Eco Logic had used, Dr. Peterson testified that this description was not detailed enough to qualify as a protocol. Dr. Peterson stated that every reliable laboratory has a written protocol, particularly with regard to a test as complex as congener specific analysis, so that a test is performed the same way each time and so that outside scientists can review the results.

Plaintiffs respond that Eco Logic *did* have such a protocol, that it was published in peer-reviewed scientific journals and that it was set out in Eco Logic's June 15, 1992 report. However, although Gierczak testified that there was a protocol, he qualified his testimony somewhat:

> We have . . . published on two occasions in particular the analysis of congener specific PCBs. So there were protocols that were established, they were modified and we have published those. But as far as a proto-

[41] Of course, even if the district court's exclusion of Gierczak's testimony had been proper, it could have been considered for purposes of determining the *admissibility* of the Eco Logic data—Rule 104(a) determinations do not have to rely on admissible evidence.

> col, because of the size of the lab and the expertise that's available within the laboratory in general, we do not have a large document for each of the particular procedures, and in this case for the analysis of congener specific PCBs. And that's basically because the people are quite well versed and we have access to expert advice.

(Peterson stated that Eco Logic changed the methodology somewhat from that set down in at least one of the cited papers. Thus, Eco Logic did not have a written version of the exact protocol used in these particular tests.

The district court also accepted Dr. Peterson's second criticism of Eco Logic: that essential quality assurance procedures were inadequate for electron capture analysis and mass spectrometry, the two processes Eco Logic used to analyze PCB levels. As quality assurance on its electron capture analysis, Eco Logic tested a lab blank (a sample of laboratory water). Dr. Peterson points out that the lab blank actually produced *higher* results for levels of specific PCB congeners then the values produced for the blood samples from plaintiff Amber Burrell. The higher results made it likely that much of the PCBs found "in" plaintiffs' blood resulted from contamination from the lab. But Gierczak testified that one has to compare *individual* PCB congeners found in the blank with those in the plaintiffs' blood rather than comparing total PCB levels. For the types of PCB congeners likely to have come from the yard, there were 10 to 15 times more congeners present in plaintiffs' blood than were present in the laboratory blank. And, in any case, even the *total* amount of PCBs in each plaintiffs' blood were two to nine times higher than the amount in the laboratory blank.

However, when given a chart formatting the numbers in a new way, Gierczak admitted on cross examination that the level of the specific PCB congeners likely to have come from the Yard was higher in the blank than in the sample for plaintiff Amber Burrell. This makes the Eco Logic electron capture analysis unreliable at least with

respect to Amber Burrell, and we will affirm the district court's ruling that this analysis was inadmissible as to her. It also undermines the reliability of the results for the other plaintiffs as well, because it shows that many of the PCBs quantified in plaintiffs' blood resulted from laboratory contamination.

As for other aspects of quality assurance, the district court found that Eco Logic did not test the "vacutainer blanks" described in the original report sent to Dr. Nisbet and tested only one of three matrix spikes (samples spiked with chemicals similar to but not identical to those being analyzed). Moreover, the matrix spike and the surrogate spikes (samples spiked with the exact type of chemicals being analyzed at set quantities), which should have produced identical recovery rates, produced recovery rates at a ratio of 1:2, which Dr. Peterson said indicated a problem in quantification. The district court also found that the results for both the matrix spike and the surrogate spikes were too high to be of much use as a test, because the spikes were measured in parts per million while the actual samples were measured in parts per billion. Although Gierczak testified that these were minor difficulties which did not undermine confidence in the recovery rates, the district court credited Peterson.

According to the district court, the quality assurance problems present in the electron capture analysis were even more pronounced in the other type of test performed by Eco Logic—mass spectrometry. For the mass spectrometry test, neither matrix nor surrogate spike samples were even analyzed, leading Dr. Peterson to conclude that, "[i]n absence of [this] recovery data, I don't think you can be confident in the results here."

Moreover, Eco Logic failed to calibrate the instruments it used for both electron capture analysis and mass spectrometry within the range occupied by plaintiffs' samples. In other words, while Eco Logic made sure that its instruments were set accurately within a certain range of

PCB detection, the readings on plaintiffs' samples ended up being outside of this range. Peterson stated that the fact that plaintiffs' samples fell outside the calibrated range made the analysis "less accurate" because it is difficult to tell how the instrument will behave at low levels of PCBs.

Gierczak responded to Peterson by explaining that the calibration was accurate if extended in a linear fashion beyond the range that had been specifically set, as long as the level of PCBs being measured was not so small that it was close to the limit of the machine's ability to detect PCBs. According to Gierczak, plaintiffs' samples were within the range at which the calibration was accurate. Again, the district court credited the testimony of Peterson rather than Gierczak.

Finally, the district court accepted Peterson's assertion that Eco Logic did not adequately confirm its electron capture results. In the electron capture analysis, the DB 17 column is used to confirm the identities of PCB congeners found on the DB 5 column where the quantific takes place.[42] Peterson stated that confirmation on the DB 17 column of each individual peak formed by a congener on the DB 5 column is necessary to ensure that individual congeners are not misidentified as other chemicals. Defendants point out that Gierczak "admitted" that the DB 17 column is "absolutely critical to the overall analysis," yet Gierczak was unable to state whether any of the 15 PCB congeners Eco Logic had found on the DB 5 column had also been identified in the DB 17 column.

Plaintiffs respond that when Gierczak testified that the DB 17 column is critical to the analysis, what he demonstrated is that the DB 17 column is critical *for the purpose of* establishing a qualitative check to determine the pres-

[42] There is no further information in the record as to what the DB 5 and DB 17 columns are: thus, we assess the importance of use of the DB 17 column solely based on the assertions of the experts as to its importance.

ence of PCBs. He stated that Eco Logic had performed such a qualitative check by engaging in a statistical analysis of 32 PCB congeners to confirm the presence of PCBs on both columns. This made comparison of individual peaks in the two columns unnecessary. Gierczak also testified that an individual comparison was not necessary to ensure that Eco Logic was measuring only PCBs and not some other compound, because Eco Logic's equipment was calibrated using a pure PCB standard. Dr. Nisbet, for his part, testified that *he* confirmed the presence of *specific* congeners by comparing chromatograms of the two columns combined with independent knowledge of where the specific peaks should be. But the congeners Dr. Nisbet relied on to make his back calculations were in fact not found in the DB 17 column results, (NT at 127-30), and the district court pointed out that the quality control manual submitted by Eco Logic says that, "[t]he presence of an analyte is confirmed only when identified on both columns." Thus still another factor supports the court's conclusions.

The district court pointed to one final methodological problem in Eco Logic's tests. It noted that the mass spectrometry and the electron capture analysis produced inconsistent results for congeners that were measured by each. Dr. Peterson testified that this points to a problem in accuracy. The district court also found that Eco Logic's report on the six plaintiffs' PCB blood levels was the first ever issued on PCB congener specific analyses of human blood samples. The novelty of Eco Logic's approach, combined with Eco Logic's flaws in quality control, led the district court to exclude the Eco Logic data under Rules 702 and 703.

Applying the *Daubert* factors, we think that whether the district court acted within its discretion in excluding this evidence is a close question. The analysis performed by Eco Logic is testable (one can verify whether the lab produces inaccurate results for samples with known levels

of PCBs); Eco Logic has published two peer-review articles about the analysis (though presumably without the specific level of quality controls present here); and, while novel, defendants do not actually challenge this methodology overall but only the quality controls employed in these particular tests. Moreover, Gierczak provides a fairly convincing defense of the quality control measures, and surely any complicated procedure will be subject to some criticisms. Dr. Nisbet, a well-qualified expert, testified that "In spite of the criticisms by Dr. Peterson and Dr. Kaley, I remain satisfied that those results are reliable, and can be used in the way that I have used them to support my conclusions."

Nonetheless, we hold that the district court acted within its discretion in excluding the Eco Logic results. Dr. Peterson, who oversees the technical aspects of a major laboratory, testified that Eco Logic had failed to perform many *standard* quality control techniques, and that those they had performed cast substantial doubt on their results. He concluded that the combinations of those flaws were so great as to render the data produced by Eco Logic unreliable. The purpose of an *in limine* hearing is to develop evidence on reliability of scientific evidence. Here there was an extensive hearing and a plethora of testimony justifying the district court's conclusion. Although as we have explained, a number of *Daubert* factors (and the general policy of the federal Rules) favor admissibility, we cannot say that a conscientious district judge could not credit a qualified witness such as Peterson that the quality control and methodological flaws were not minor problems but were so great as to undermine the data to the extent that it may not reasonably be relied on by experts in the relevant field and would be unhelpful to the jury. The ruling of the district court will therefore be affirmed.

D. *Remaining Issues*

Plaintiffs assert that there was *no* justification for the district court's total exclusion not only of Dr. Nisbet's testimony based on the three methods of calculating PCB exposure, but of the balance of it as well. For Dr. Nisbet also opined as to human epidemiological studies and animal studies showing causal links between PCBs and disease. He testified that the AML results themselves showed PCB levels above background levels (though on what basis he was calculating background is unclear), and that AML's chromatograms show, especially for the Burrell plaintiffs, a pattern that is consistent with their having had significantly higher exposure at a prior date. Dr. Nisbet testified that the assumption that plaintiffs' blood was within background levels was based on studies of people who had occupational or residential exposure to PCBs, not studies of members of the general public with average PCB exposure, (A673, 675, 4181), and that a 1987 exposure study (ATSDR) showed PCB levels much higher than background for 89 Paoli residents despite the ATSDR conclusion to the contrary. Finally, Dr. Nisbet testified that plaintiffs had a significant risk of developing illnesses in the future. Plaintiffs are correct that the district court provides no justification for excluding any of this testimony and that it must therefore be admitted.

E. *Conclusion*

We will uphold the district court's exclusion of Dr. Nisbet's recalculation of AML lab tests and of his back calculations based on the Eco Logic data. However, we will reverse the court's exclusion of Dr. Nisbet's analysis of background levels based on his conversion of the NHATS fat data into blood levels; we will also reverse the district court's exclusion of the remainder of Dr. Nisbet's testimony. Thus, at least with respect to those plaintiffs for whom Dr. Nisbet testified, including the two who have viable personal injury claims, Dr. Nisbet's provides sufficient evidence of exposure to defendants' PCBs

(by testifying that the AML blood tests showed levels above background) for them to survive summary judgment on the exposure issue.

VIII. THE HARMFULNESS OF THE CHEMICALS

A. *Introduction*

The plaintiffs advanced several types of evidence to demonstrate that PCBs are harmful, including the testimony of Drs. Sherman and DiGregorio that the illnesses of specific plaintiffs were caused by PCBs, some limited epidemiological studies to which Dr. Nisbet testified, animal studies on the health effects of PCBs, and incidents at Yusho and Yu Cheng in which many individuals were exposed to substantial amounts of PCBs and became ill. The plaintiffs also presented evidence that they had been exposed to chemicals other than PCBs arising from the Yard (e.g. furans and dioxins) and that these chemicals were dangerous.

In addition to excluding the testimony of Drs. Sherman, DiGregorio and Nisbet as detailed above, the district court excluded animal studies on the health effects of PCBs, data on any chemicals other than PCBs, and any data stemming from the incidents at Yusho and Yu Cheng. We have already reversed the district court's exclusion of Dr. Nisbet's testimony on epidemiological studies. For the reasons that follow, we will also reverse the district court's exclusion of the animal studies but will uphold its exclusion of non-PCB related data (data on furans and dioxins) and data from the Yusho/Yu Cheng incidents.

B. *Animal Studies*

The district court found animal studies to be irrelevant under Rule 402. The court also found use of the data to be unreliable, presumably under Rule 703, and that "use of that data would tend to mislead or confuse the jury and would be of no assistance to the jury in deciding the

issues in this case," thereby presumably invoking Rules 702 and 403. In reaching these conclusions, the district court relied on the testimony of Dr. Robert C. James, an Associate Professor at the Center for Environmental and Human Toxicology at the University of Florida. Dr. James asserted that test animals are often very sensitive to chemicals due to breeding, overeating, and physiological, biological and metabolic pathways which are different than those of humans. Dr. James also explained that test animals are given extremely high doses of the chemicals. Thus, studies of test animals identify many chemicals as carcinogenic in animals that are not carcinogenic in humans (James T. 91-92). Apparently crediting Dr. James, the district court found that use of animal studies as a basis for reaching a conclusion on causation of adverse health effects in humans is unreliable *when that data is contradicted by significant epidemiological data in humans.*

However, the district court did not cite any evidence demonstrating that significant epidemiological data contradicted the animal studies.[43] And Dr. Nisbet cited some occupational studies that he concluded supported the animal studies. According to Dr. Nisbet, these studies showed that exposure to PCBs caused elevated levels of enzymes associated with liver damage, skin irritation, the early forms of chloracne, elevated lipids, and skin, liver and

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[43] The court did point to Dr. James' testimony that "the consensus opinion is that chloracne is the only conditional disease that is known to [be causally] associated with occupational PCB exposure." (JA 5570). But, even if uncontradicted, this statement only indicates a lack of epidemiological studies definitively showing that PCBs do cause various diseases: it does not identify data showing that PCBs do not cause various diseases. As Dr. Molholt, an EPA toxicologist, explains, "human epidemiologic studies have not *conclusively* linked PCB exposure to any significant human disease, i.e., the studies thus far have been inconclusive. How can inconclusive studies constitute strong evidence [that PCBs do not cause disease]?" JA 4078 (emphasis added).

pancreatic cancer.[44] Additionally, an article by Dr. Nicholson explains that when there is a concordance of animal data and human data, it strengthens the reliability of each.

Moreover, Dr. Nisbet testified that scientists routinely use animal studies to assess risks of chemicals to humans. Even defendants' own experts based their opinions partly on animal studies showing that they are at least relevant to assessing causation in humans. *See e.g.* Dr. Kelly's testimony. Dr. Nisbet added that animal studies are particularly valuable with respect to assessing health effects of PCBs, because humans and monkeys have shown similar sensitivity to PCDFs and thus are likely to show similar sensitivity to PCBs.[45] Finally, EPA has relied on animal studies to draw conclusions about the effects of PCBs on humans.

Dr. Molholt, EPA's toxicologist at the Yard, explained:

> in the absence of epidemiologic proof, this statement [criticizing animal studies] implies that PCBs are exonerated. No! In the absence of epidemiologic proof in humans we must drop to our second tier in the understanding of human carcinogenic prediction: Animal testing. And there the scientific evidence is conclusive.

Molholt adds that "PCBs are not only considered as 'potential' human carcinogens, but as *probable* human carcinogens (Class B) by the Agency on the basis of

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[44] The studies themselves were not provided in the record.

[45] Defendants argue that Dr. Nisbet's testimony on the relevance of animal studies is itself irrelevant because Dr. Nisbet's testimony was deemed generally inadmissible. However, even if Dr. Nisbet's tesitmony about the level of PCBs in plaintiffs' blood was properly excluded, and we have held that it was not, there would be no justification for excluding his testimony about animal studies. Nor does his testimony have to be admissible for it to be relevant to determining the admissibility of animal studies. *See* Fed. R. Evid. 104(a).

conclusive experiments in test animals." In fact, EPA thinks that PCBs have the same carcinogenic potency as vinyl chloride, which is one of only 14 chemicals that EPA has indicated have been proven to be carcinogenic by epidemiological studies. The "more probable than not" standard employed by EPA is the same standard that is employed in civil litigation.

The case law on the admissibility of animal studies in various contexts is mixed.[46] Many cases have held that the studies are admissible. *See, e.g., In re Bendectin Products Liability Litigation*, 732 F. Supp. 744, 749 (E.D. Mich. 1990) (experts in the field think that it is reasonable to rely on non-epidemiological studies to link Bendectin to birth defects); *Hagen v. Richardson-Merrell, Inc.*, 697 F. Supp. 334, 337 (N.D. Ill. 1988) (defendants did not adequately demonstrate that expert opinion based partly on animal studies should be excluded); *Saakbo Rubanick v. Witco Chemical Corp.*, 576 A.2d 4, 7, 15 (N.J. Super. 1990) (under New Jersey law reversing trial court's exclusion of expert testimony, which was partly based on animal studies, that PCBs caused cancer). In *Villari v. Terminix International, Inc.*, 692 F. Supp. 568, 570 (E.D.Pa. 1988), Judge Pollak explained that:

> While it may be true that defendant can offer tests and experiments that do not support the findings of plaintiffs' experts, the defendant cannot deny that animal studies are routinely relied upon by the scientific community in assessing the carcinogenic effects of chemicals on humans. Even defendant's own expert acknowledges that animal experiment studies are built on 'prudent presumptions,' although he concludes that they should not be admitted.

While other cases have held that animal studies are inadmissible, these cases are for the most part distinguish-

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[46] All of these cases were decided prior to *Daubert*.

able because most involved the exclusion of animal studies in the face of *extensive* epidemiological data that failed to support causation, because none involved studies on animals particularly similar to humans in the way they react to the chemical in question, and because none involved studies the federal government had relied on as a basis for concluding the chemical was a probable health hazard. *See In re "Agent Orange"*, 611 F. Supp. at 1241 (excluding animal studies of Agent Orange based partly on the court's earlier conclusion that there was significant contrary epidemiological data, that the Center for Disease Control had concluded that the animal studies did not demonstrate adverse human health effects, and that the animal studies gave pregnant females high doses at critical times) (citing *In re "Agent Orange" Product Liability Litigation*, 603 F. Supp. 239, 246-47 (1985) (*"In re "Agent Orange" I"*)); *Viterbo v. Dow Chemical Co.*, 826 F.2d 420 (5th Cir. 1987) (excluding the evidence where there was only a single animal study of picloram and it showed a link to a disease completely different than plaintiff's diseases); *Richardson v. Richardson-Merrell, Inc.*, 857 F.2d 823, 830 (D.C. Cir. 1988) (excluding animal studies of Bendectin because of the overwhelming body of contrary epidemiological evidence and the admissions of the expert that animal studies merely raise a suspicion of causation in humans); *Lynch v. Merrell-National Laboratories*, 830 F.2d 1190, 1194 (1st Cir. 1987) (excluding animal studies of Bendectin where they stood in face of significant contrary epidemiological data); *Turpin v. Merrell Dow Pharmaceuticals, Inc.*, 959 F.2d 1349, 1360 (6th Cir.) (excluding the testimony where the record failed to make clear how the animal studies were sufficient to show that Bendectin causes birth defects more probably than not), *cert. denied*, 113 S. Ct. 84 (1992).[47]

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[47] We recognize that while all of these cases are somewhat distinguishable on their facts, both *In re Agent Orange* and the district court in *Lynch* to some extent did rely on general problems

Here, where the EPA has relied on animal studies to conclude that PCBs are a probable human carcinogen, where there is reason to think that animal studies are particularly valuable because animals react similarly to humans with respect to the chemical in question, and where the epidemiological data is inconclusive and some of it supports a finding of causation, we think that the district court abused its discretion in excluding the animal studies. Certainly, the evidence meets the relevance requirements of Rule 402 and we think, after taking a hard look, that it also meets the reliability requirement of Rules 702, 703 and 403.

Applying the *Daubert* factors, animal studies themselves are testable (the hypothesis that PCBs cause a particular disease can be verified or disproven in the particular animal study, in other animal studies, or in human epidemiological studies). Animal studies follow a generally accepted methodology (all of the experts who testified here accepted the methodology for the purpose of proving whether a particular chemical is harmful in animals). They have been peer reviewed (the studies referred to by experts in this case were published in peer review journals). They are used for purposes outside of litigation. Finally, although their "fit" to proof of causation in humans is in dispute, all experts acknowledge they are of some use—at least in eliminating those chemicals not likely to cause disease in humans. Given the specifics of the animal studies here, the district court should not have excluded the studies as based on unreliable data and as unhelpful.

The district court also abused its discretion in concluding that the probative value of the animal studies was substantially outweighed by unfair prejudice and waste of time. The court said nothing about why expert reliance

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with extrapolating from animal studies in excluding such studies. *See In re Agent Orange*, 611 F. Supp. at 1241; *Lynch v. Merrell-National Laboratories*, 646 F. Supp. 856, 866 (D. Mass. 1986).

on animal studies is more prejudicial than any other scientific studies as we required in *Downing*, and there is significant evidence in the record from sources such as the EPA that the evidence is quite probative with respect to PCBs. In *Paoli I* we said with respect to the district court's exclusion of animal studies under Rule 703 that "It is not clear that the court was not merely choosing between opinions as opposed to excluding plaintiff's opinion on evidentiary grounds." *Paoli I*, 916 F.2d at 853. On this point the district court still seems to be choosing between opinions. We therefore hold that the animal studies pass *Daubert* muster, are admissible, and are one source by which plaintiffs can prove the harmful effects of PCBs.

C. *Exposure to Dioxins and Furans*

Plaintiffs assert that in addition to being exposed to PCBs, they were exposed to dioxins and furans.[48] The district court, however, excluded testimony regarding chemicals other than PCBs. It also found that the plaintiffs could not demonstrate that they had been exposed to dangerous quantities of dioxins and furans; it thus excluded evidence regarding these chemicals as irrelevant under Rule 402 and as substantially more unfairly prejudicial and likely to cause undue delay than probative under Rule 403. We affirm.

Plaintiffs point to evidence showing that furans can be present in unused transformer fluids at up to 20 parts per million and at still higher levels in waste transformer fluids. Furthermore, they note, PCB-based transformer fluids produce still more dioxins and furans when heated,

[48] Plaintiffs also claimed that they had been exposed to epoxide dicylodiepoxy carboxylate and tin tetraphenyl. The district court found that while tin tetraphenyl and EDDC did exist as a small percentage of the dielectric fluid in the Yard, no soil or blood or tissue samples were ever tested to show the presence of these chemicals in or near the plaintiffs, and excluded the evidence. The plaintiffs do not challenge that ruling on appeal.

see Literature Review of Pyriolysis and Combustion Products of Selected Utility Materials, (Nov. 1986), and affidavits show there were various heat producing activities that took place at the Yard. Plaintiffs then argue that it is reasonable to conclude that these furans and dioxins leaked from the Yard onto plaintiffs' soil, because a worker spread waste transformer fluids from the drums directly on the parking lot, and that some of these fluids, if they followed normal water run off patterns, would have entered plaintiffs' yards. Dr. Kopstein buttressed the plaintiffs' argument. He explained that "fires at the yard would had to have produced furans and dioxins;" as a result, he "concluded that . . . there was an ongoing and continuous release of PCBs and most likely to a reasonable—within a reasonable degree of scientific certainty furans and dioxins, into the neighborhood during that 35-year period."

The district court found that, although dioxins and furans *were* measured in the Yard, they were measured in quantities below the Center for Disease Control's ("CDC") level of concern. Because soil in the Yard was the only sample of any sort tested for dioxins and furans, the district court found the soil readings in the Yard to be basically conclusive of the fact that dioxins and furans were not present in sufficient quantities to injure. The court was not moved by Dr. Kopstein's testimony, because he could not quantify exposure due to the absence of data on soil concentration off the site. Furthermore, the court cited the testimony of Dr. James who stated that the dose of a chemical a person takes into his or her body cannot be calculated very well from the amount of chemical to which they have been exposed. Thus, because it concluded that plaintiffs had not been exposed to enough dioxins and furans to cause injury, the court ruled that evidence about these chemicals should be excluded under Rule 402 as irrelevant and under Rule 403 as substantially more (unfairly) prejudicial than probative and as likely to cause undue delay.

Plaintiffs respond to the district court's rulings by arguing that the soil sample showing levels of dioxins and furans at levels below CDC concern was from only 10 inches of soil on the 28 acre railroad yard and thus should not be given the dispositive weight accorded to it by the district court. Although plaintiffs do not contest the district court's finding that they cannot quantify their furan intake, they assert that the importance of lack of quantification is a matter for the jury to decide. They cite three cases in which courts refused to grant summary judgment despite plaintiffs' inability to quantify exposure to chemicals at levels sufficient to cause disease. *See Junge v. Garlock, Inc.* 629 A.2d 1027, 1029-30 (Pa. Super. 1993) (holding that an expert's testimony that asbestos at plaintiff's job was a substantial factor in causing his asbestosis was admissible despite the inability of the expert to quantify plaintiff's exposure; this was true despite testimony that defendants' asbestos only emitted a low level of dust); *Ferebee v. Chevron Chemical Co.*, 552 F. Supp. 1293, 1298 (D.D.C. 1982), *aff'd* 736 F.2d 1529 (D.C. Cir. 1984), *cert. denied* 469 U.S. 1062, 105 S. Ct. 545 (1984); *Ruiz v. Minnesota Mining and Manufacturing Co.*, 93 Cal. Rptr. 270, 273-74 (Cal. App. 1971).

It would seem that, in making an overall assessment of the likelihood that plaintiffs' injuries were caused by activities at the Yard, evidence about furans and dioxins is at least minimally relevant. It is not clear why the CDC levels are definitive evidence of safe levels. Nor is it clear that the level plaintiffs were exposed to was below CDC levels. Plaintiffs raise significant questions about the reliability of the soil samples at the Yard.[49] But, while

[49] Plaintiffs also cite the testimony of Dr. Bruce Molholt, the EPA's toxicologist working at the Yard, who stated that "a preliminary sampling for PCDFs has turned up contamination in the area of concern three times the equivalence deemed a soil action level by CDC." (JA 4078). Plaintiffs provide no indication as to whether this preliminary estimate was later revised, which significantly weakens the value of this testimony.

we think that the evidence would pass muster under Rule 401, *see Williams v. West Chester*, 891 F.2d 458, 466 (3d Cir. 1989), which has a low threshold relevancy, we think that the district court acted within its discretion in excluding this evidence under Rule 403.

The probative value of plaintiffs' evidence is lower than in the cases plaintiffs cite above. In *Junge*, for example, defendants submitted no evidence that the level of asbestos in defendants' plant was too low to cause injury. Here, defendants have submitted evidence showing that the furans produced were below CDC levels of concern. Moreover, it seems more reasonable to conclude that the *asbestosis* at issue in *Junge* was caused by a low level of *asbestos* on defendants' property than to conclude that the various illnesses here were caused by low levels of furans on defendants' property. There are fewer alternative causes of asbestosis than there are alternative causes for the injuries being attributed to furans. Finally, we note that neither *Junge*, nor the two non-Pennsylvania cases cited by plaintiffs, involved circumscribed appellate review of a trial court decision excluding evidence.

The district court was within its discretion in holding that the minimal relevance of this evidence was substantially outweighed by its potential for unfair prejudice and thus should be excluded under Rule 403. Given that there is little evidence that plaintiffs' exposure to furans or dioxins was significant, the district court properly held that admitting evidence that plaintiffs were exposed to these chemicals as well as evidence about the significant negative effects of these chemicals would have been too inflammatory for the jury. This is especially true given the negative publicity that dioxin (Agent Orange) has received and that currently many experts think furans are significantly more dangerous than PCBs. *See also* the discussion of prejudice regarding the Yusho, Yu Cheng incidents *infra* pp. 124-125. Moreover, allowing in evidence regarding chemicals other than PCBs would create the need

to have mini-trials on plaintiffs' exposure to each of these chemicals and the harm they cause; this would cause "undue delay" given the minimal relevance of the evidence. Fed. R. Evid. 403.[50]

IX. THE YUSHO AND YU CHENG INCIDENTS

The district court also precluded admission of evidence about the incidents at Yusho, Japan, and Yu Cheng, Taiwan, where individuals were exposed to both furan- and PCB-contaminated cooking oil. *See Paoli I*, 916 F.2d at 840, 854. Plaintiffs relied on these incidents as part of their evidence that both PCBs and furans are hazardous to humans, because after both incidents there were outbreaks of various illnesses within 20 to 150 days.

The district court, however, cited several studies and the testimony of Dr. James for the proposition that furans rather than PCBs were the primary agent responsible for the illnesses at Yusho and Yu Cheng. Dr. James noted that the pattern of illnesses at Yusho and Yu Cheng has not been duplicated in workers exposed only to PCBs; moreover, the victims at Yusho and Yu Cheng remained ill when their PCB levels, but not their furan levels, returned to normal. The district court concluded that plaintiffs' lack of exposure to furans combined with the fact that the pattern of illnesses in Paoli residents were not similar to those at Yusho and Yu Cheng made these incidents irrelevant. Furthermore, the court added that the prejudicial effect of (admitting evidence on these incidents would be high, because the incidents "concern a widespread poisoning caused by a substance to which Plaintiffs cannot establish they were exposed."

Plaintiffs contend that the district court should have admitted evidence about Yusho and Yu Cheng even if

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[50] Although we have been cautions in permitting pretrial exclusion on Rule 403 grounds, here the record was sufficient extensive to permit its application.

plaintiffs' evidence that they were exposed to furans is excluded. Plaintiffs cite Dr. Nisbet's testimony that Yusho and Yu Cheng provide important evidence about *PCBs* because these incidents involved human exposure to significant quantities of PCB and thus show the manner in which PCBs are distributed in the body and their half lives. Dr. Nisbet added that, by providing evidence about furans, Yusho and Yu Cheng provide evidence on the health effects of PCBs. This is because furans and PCBs have similar chemical structures, act by the same mechanisms, and have similar toxicity. Plaintiffs also cite the testimony of Dr. Kenneth Chase, one of defendants' experts who testified to the structural similarity and comparable toxicity of furans and PCBs. In fact, Dr. Chase asserted that "probably one of the biggest developments [in the history of PCBs] that ever took place was Yusho."

As with the contention that plaintiffs were exposed to furans and dioxins, we hold that the district court improperly excluded evidence concerning Yusho and Yu Cheng as irrelevant, given the low threshold of relevancy of Rule 401. We think that it was relevant to the effects of PCBs both by showing possible harms of PCBs directly and indirectly (by showing harms of furans which are structurally similar to PCBs). Dr. Nisbet and Dr. Chase both testified to this. As we held in *Paoli I*, the district court cannot exclude evidence with respect to Yusho and Yu Cheng based on its conclusion that there is a "consensus" that Yusho and Yu Cheng are irrelevant in analyzing the effects of PCBs. The court, we noted, has not pointed to evidence showing the existence of such a consensus. *See Paoli I*, 916 F.2d at 854; *cf. id.* at 858 (holding that evidence that PCBs cause liver cancer is probative of the fact that PCBs cause other forms of cancer and so is admissible even in the absence of plaintiffs with liver cancer).

That said, we hold that the district court was within its discretion in concluding that the prejudicial effect of

evidence about Yusho and Yu Cheng is attended by unfair prejudice that outweighs its probative value given that the relationship of PCBs to the illnesses of the victims in the two incidents is attenuated and given the risk that the jury would be unduly influenced by the illnesses of the numerous victims—illnesses largely caused by furans rather than PCBs. Moreover, development of evidence about Yusho and Yu Cheng would be a significant waste of time due to their limited relevance, requiring mini-trials on the exposure, types of illnesses, and causes of illnesses of individuals during these incidents.

X. THE PLAINTIFFS' PERSONAL INJURY CLAIMS —SUMMARY AND CONCLUSION

As a result of our review of the district court's admissibility decisions, we reverse its grant of summary judgment with respect to those present injury claims of Bessie Cunningham and Amber Burrell, as we have detailed above, *see supra* p. 88, 90. We affirm the district court's grant of summary judgment on all of the other personal injury claims.

Those plaintiffs for whom Dr. Nisbet testified, including both Bessie Cunningham and Amber Burrell, presented sufficient evidence to survive summary judgment on the exposure issue. Although we have upheld the district court's exclusion of much of Dr. Nisbet's testimony, we have reversed its exclusion of his recalculation of background levels using NHATS fat data. Based on this recalculation, Dr. Nisbet concluded that the levels of PCBs in plaintiffs' blood were above background. This testimony, especially when combined with soil samples of PCBs in plaintiffs' yard at levels EPA does not consider safe and with evidence that the plaintiffs played in those yards and ate vegetables grown in those yards, constitutes sufficient evidence of exposure.

Bessie Cunningham and Amber Burrell also presented sufficient evidence of the harmful effects of PCBs and that

PCBs caused many of their particular illnesses. While we have upheld the district court's exclusion of evidence concerning chemicals other than PCBs and of evidence related to Yusho and Yu Cheng, we will reverse the district court's exclusion of animal studies on the effects of PCBs. The animal studies combined with Dr. Nisbet's testimony with respect to epidemiological studies and Dr. Sherman's testimony that, given her review of the literature, her consideration of illnesses in the Paoli population, and her review of the medical examinations and histories of Bessie Cunningham and Amber Burrell, the illnesses of these two particular plaintiffs were caused by PCBs, constitutes sufficient evidence for a reasonable jury to find defendants liable. Thus, we will reverse the district court's grant of summary judgment on those present injury claims of Bessie Cunningham and Amber Burrell.

We will, however, affirm the district court's grant of summary judgment with respect to the present injury claims of all of the other plaintiffs. Because the district court acted within its discretion in excluding the testimony of Drs. Sherman and DiGregorio that PCBs caused the particular illnesses of these plaintiffs, they have no admissible evidence on causation. Thus, the district court's grant of summary judgment was proper.

XI. THE MEDICAL MONITORING CLAIMS

All of the plaintiffs except James Lament have brought claims for medical monitoring that will enable early detection and prompt treatment of any PCB related diseases. Many of the plaintiffs have also brought claims for fear of disease and increased risk of disease. We consider first whether medical monitoring is cognizable in Pennsylvania, second, what the elements of the cause of medical monitoring are, and third, whether the plaintiffs have provided sufficient admissible evidence to make out such a claim.

A. *Medical Monitoring as a Viable Claim.*

In *Paoli I* we attempted to predict the holding of Pennsylvania courts on a claim for medical monitoring. We concluded that such a claim was cognizable under Pennsylvania law. Defendants argue that subsequent Pennsylvania decisions undercut our conclusion that medical monitoring is a viable cause of action in Pennsylvania. The district court declined to decide the issue because it found that, in any case, there was not enough evidence to prove a claim for medical monitoring. We disagree. We think that medical monitoring is still a viable claim under Pennsylvania law and that the plaintiffs have presented sufficient evidence to survive summary judgment on that claim.

Defendants point to several cases as precluding the viability of medical monitoring claims in Pennsylvania. In the first of these cases, *Marinari v. Asbestos Corp.*, 612 A.2d 1021, (Pa. Super. 1992), an en banc Pennsylvania Superior Court adopted the "two-disease approach" to asbestos litigation. Under this approach, asbestos plaintiffs do not need to bring claims for possible future injuries at the same time they bring claims for present injuries. Plaintiffs do not have to, and in fact cannot, bring claims for a risk of future cancer at the time they sue for a disease they already have. They must bring their cancer claim only if and when they actually contract cancer. The *Marinari* court reasoned that adjudicating future risk of disease is too speculative and would result in undercompensation for some plaintiffs and overcompensation for other plaintiffs. *See id.* at 1026.

In *Morrison v. Fibreboard Corp.*, 630 A.2d 436, 437-38 (Pa. Super. 1993) and *Higginbotham v. Fibreboard Corp.*, 630 A.2d 14, 15-16 (Pa. Super. 1993), Pennsylvania courts interpreted *Marinari* to rule out claims for damages based on fear of future injuries as well as risk of future injuries—they stated that any distress arising out of fear

of cancer can be compensated at the time that malignancy occurs.[51]

Defendants argue that *Marinari* and related case law precludes the plaintiffs from bringing medical monitoring claims. Although none of these cases specifically addresses such claims, defendants assert that such claims are excluded by the language of the opinions. In explaining why plaintiffs could not bring claims for risk of a future disease, the *Morrison* court explained that this was "[b]ecause the *Marinari* Court, however, found juries must now base their verdicts not upon sheer speculation as to possible future damages, but rather upon only empirical or physically objective evidence of present injury." 630 A.2d at 437. Similarly, in *Ottavio v. Fibreboard Corp.*, 617 A.2d 1296, 1302 (Pa. Super. 1992) (en banc), the Superior Court stated that, "In an action for exposure to asbestos, a plaintiff's claim may encompass only the harm caused by the diseases which have become manifest." The defendants argue that because medical monitoring is a claim that arises before a disease has "become manifest," before there is "empirical or physically objective

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[51] In addition to claims for medical monitoring, some plaintiffs have brought claims for increased fear and risk of disease. We are satisfied that the Pennsylvania Supreme Court would follow the lead of the strongly reasoned Superior Court decisions in *Marinari*, *Morrison*, and *Higginbotham*. Thus, under current Pennsylvania law, the plaintiffs in this case have no cause of action for risk or fear of future injuries. We will therefore not spend further time discussing these claims but will affirm the district court's grant of summary judgment on all of them.

Plaintiffs cite *Hackney v. Woodring*, 622 A.2d 286 (Pa. Super. 1993) for the proposition that there is no need for expert testimony on a plaintiff's level of distress is accurate, but that case assumes that plaintiffs have made out the other elements of a claim of intentional infliction of emotional distress, and *Morrison* and *Higginbotham* make clear that toxic tort litigation is not the type of situation in which such a claim is applicable.

We therefore have no need to evaluate the district court's conclusions that Dr. DiGregorio's and Dr. Schecter's testimony on fear of disease is inadnissible.

evidence of present injury," medical monitoring is not a viable claim in Pennsylvania.

One Pennsylvania Court of Common Pleas has explicitly agreed with the defendants. *See Addams v. Westinghouse Electric Corp.*, No. 1340 C.D. 1988, slip op. at 16 (Pa. Ct. Com. Pleas, Mercer County, July 30, 1993) ("Based on *Marinari*, and the two-disease rule, this Court feels an action for medical monitoring is inappropriate. . . . [A] cause of action for future risk of cancer does not exist, the same policy issues underlie both actions."). And, according to the defendants, one Superior Court panel has implicitly agreed with their reading of Pennsylvania law. *Giffear v. Johns-Manville Corp.*, 632 A.2d 880 (Pa. Super. 1993) (holding that claims for asymptomatic pleural thickening caused by exposure to asbestos were not cognizable).[52]

To support their reading of *Giffear*, the defendants point to Judge Del Sole's concurrence, in which he asserted that, "the majority wrongly assumes that a person with asymptomatic pleural thickening has no damages . . . . [O]nce one is diagnosed with pleural thickening, there may be medically necessary reasons for increased medical monitoring of the lungs to provide early detection of cancer." *Id.* at 890 (Del Sole, J., concurring). Defendants argue that by failing to address the concurrence's claim that asymptomatic pleural thickening might sometimes justify a claim of medical monitoring and by holding that asymptomatic pleural thickening does not give rise to a cognizable claim, the majority implicitly ruled that medical monitoring claims are never justified.

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[52] *Giffear* did rule out claims for present injuries that are asymptomatic. We have no reason to believe that the Pennsylvania Supreme Court would reach a different result. Thus, in discussing plaintiffs' claims for present injuries, *supra*, we affirmed the district court's grant of summary judgment on plaintiffs' asymptomatic "injuries."

However, while the course the Pennsylvania courts have taken since *Paoli I* casts some doubt on whether they would accept a medical monitoring claim, it does not cause us to change the conclusion that we reached in *Paoli I* that Pennsylvania would recognize such a claim. "[I]n the absence of a *clear* statement by the Pennsylvania Supreme Court to the contrary or other persuasive evidence of a change in Pennsylvania law, we are bound by the holdings of previous panels of this court." *Smith v. Calgon Carbon Corp.*, 917 F.2d 1338, 1343 (3d Cir. 1990), *cert. denied*, 499 U.S. 966, 111 S. Ct. 1597 (1991). No such "clear statement" or "persuasive evidence" exists here.

The *Giffear* majority was not addressing a claim for medical monitoring and made no reference to Judge Del Sole's concurrence. Thus, no Pennsylvania court other than the single trial Court in Mercer County has directly addressed the medical monitoring question. And although some language in Superior Court decisions since *Paoli I* seems to exclude medical monitoring claims, the policy concerns behind those decisions do not.

Both *Morrison* and *Higginbotham* were based on the Superior Court's concern that actions for fear of cancer, like actions for risk of cancer, involve significant speculation as to damages. However, the Pennsylvania courts' worries about speculative verdicts is the same worry they expressed in placing limitations on claims for risk of future injuries in *Martin v. Johns-Manville Corp.*, 494 A.2d 1088 (Pa. 1985).

In *Paoli I*, we distinguished *Martin* by saying that:

> The injury in an enhanced risk claim is the anticipated harm itself. The injury in a medical monitoring claim is the cost of the medical care that will, one hopes, detect that injury. The former is inherently speculative because courts are forced to anticipate the probability of future injury. The latter is much less speculative because the issue for the jury is the

> less conjectural question of whether the plaintiff needs medical surveillance. Second, the Pennsylvania Supreme Court's concerns about the degree of certainty required can easily be accommodated by requiring that a jury be able reasonably to determine that medical monitoring is probably, not just possibly, necessary.

916 F.2d at 850-51; *see also Mauro v. Raymark Industries,* 561 A.2d 257, 263 (N.J. 1989) (rejecting plaintiff's claim for damages based on an enhanced risk of cancer but allowing a claim for medical monitoring); *cf. Meyerhoff v. Turner Constr. Co.,* Volume N.W.2d 847, (Mich. 1993) (holding that medical monitoring was a valid claim under Michigan law and did not require excessive speculation as to the level of damages). Thus, the Pennsylvania Superior Court decisions since *Paoli I* are not the "clear statement" or "persuasive evidence of a change in Pennsylvania law," we have required in order to depart from a prior precedent of this court. *Calgon,* 917 F.2d at 1343.

B. *The Medical Monitoring Test Restated*

In *Paoli I,* we set out the following elements as necessary to make out a medical monitoring claim:

> 1. Plaintiff was significantly exposed to a proven hazardous substance through the negligent actions of the defendant.
>
> 2. As a proximate result of exposure, plaintiff suffers a significantly increased risk of contracting a serious latent disease.
>
> 3. That increased risk makes periodic diagnostic medical examinations reasonably necessary.
>
> 4. Monitoring and testing procedures exist which make the early detection and treatment of the disease possible and beneficial.

Paoli I, 916 F.2d at 852. We stated that, "the appropriate inquiry is not whether it is reasonably probable that

plaintiffs will suffer harm in the future but rather whether medical monitoring is, to a reasonable degree of medical certainty, necessary in order to diagnose properly the warning signs of disease." *Id.* at 851. But we cautioned that a jury must "be able reasonably to determine that medical monitoring is probably, not just possibly necessary." *Id.* at 851.

Since our decision in *Paoli I*, some courts that have allowed medical monitoring claims have imposed threshold requirements that a plaintiff must meet to show that a chemical has significantly increased his or her risk of disease, and defendants argue that we should follow these courts. But we have no basis for predicting that Pennsylvania would adopt these threshold requirements. In *Theer v. Philip Carey Co.*, 628 A.2d 724, 733 (N.J. 1993), the New Jersey Supreme Court made clear that the medical monitoring cause of action it originally set forth in *Ayers v. Jackson*, 525 A.2d 287 (N.J. 1987), is not "easily invoked" and that it can only be invoked by plaintiffs "who have . . . experienced direct and hence discrete exposure to a toxic substance and who have . . . suffered an injury or condition resulting from that exposure and whose risk of cancer [can] be limited and related specifically and tangibly to that exposure." Thus, a plaintiff who was exposed to asbestos by laundering her husband's clothes had no viable medical monitoring claim—it was too difficult to quantify her exposure or to separate any potential risk from that caused by her smoking. *See id.*

We are not certain as to the import of *Theer*. It may not apply to plaintiffs who have PCBs in their own soil. At all events, we have no persuasive evidence that Pennsylvania would adopt New Jersey's rule. *See Calgon*, 917 F.2d at 1343. Someone indirectly exposed to one chemical might have as much risk of disease as someone directly exposed to another chemical, and yet New Jersey's rule would allow only the person directly injured to bring a medical monitoring claim.

Defendants also cite *Abuan v. General Electric Co.*, 3 F.3d 329, 334 (9th Cir. 1993), in which the Ninth Circuit concluded that statements by experts that a group of plaintiffs had a significantly increased risk of cancer as a result of exposure to PCBs was insufficient under the *Paoli I* standard for medical monitoring. The court explained that, "[n]either expert . . . attempted to state how 'significant' or relative the increased risk was for any individual, either in the abstract or as compared to other members of the class. Thus, their evidence failed to meet the *Paoli* significance standard." *Id.* But where experts individualize their testimony to a group of individuals with a common characteristic (*i.e.*, levels of exposure to chemical X above Y amount), we do not think there is a need for greater individualization so long as they testify that the risk to each member of the group is significant. We fail to see the purpose in requiring greater individualization. Nor do we think that an expert must quantify the increased risk. *See Ayers,* 525 A.2d 287 (N.J. 1987) (holding that where medical experts testified that a group of 300 plaintiffs who had drunk contaminated well water were subject to a significant but unquantifiable increased risk of cancer, the plaintiffs had made out a medical monitoring claim).

We are not overly concerned about the possibility of a flood of litigation absent a per se rule requiring direct exposure, actual injury, and testimony about an individual's particular level of exposure, because a plaintiff is not likely to desire to submit to additional medical tests unless he or she thinks the tests are really needed. And the damages available in a medical monitoring claim—the cost of the tests—are not likely to be high enough to provoke a flood of litigation. We predict that Pennsylvania would not want to make the cost of bringing a medical monitoring claim so high (by requiring extensive study of the particular plaintiff) that it would never be worthwhile to bring such a claim.

Nonetheless, as is apparent from the test we set forth in *Paoli I*, we think that Pennsylvania would set some limits on medical monitoring claims. And we think that the Utah Supreme Court test has encapsulated the limits we set forth in *Paoli I*. In order for a plaintiff to show significant exposure that causes a significantly increased risk to plaintiff of contracting a serious disease that makes periodic testing reasonably necessary, we think that a plaintiff must:

> prove that by reason of the exposure to the toxic substance caused by the defendant's negligence, a reasonable physician would prescribe for her or him a monitoring regime different than the one that would have been prescribed in the absence of that particular exposure. This is because under this cause of action, a plaintiff may recover only if the defendant's wrongful acts increased the plaintiff's incremental risk of incurring the harm produced by the toxic substance enough to warrant a change in the medical monitoring that otherwise would be prescribed for that plaintiff.

Hansen v. CCI Mechanical, Inc., 858 P.2d 970, 980 (Utah 1993).[53]

The court continued:

> [I]f a reasonable physician would not prescribe it for a particular plaintiff because the benefits of the monitoring would be outweighed by the costs, which may include, among other things, the burdensome frequency of the monitoring procedure, its excessive price, or its risk of harm to the patient, then recovery would not be allowed.

Id.

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[53] If there are alternative causes of a plaintiff's need for medical monitoring, Pennsylvania tort law requires that a plaintiff demonstrate that defendant's actions were a substantial factor in the plaintiff's need for medical monitoring.

C. *Application of the Test*

In order to assess whether the plaintiffs presented sufficient evidence to survive summary judgment on their medical monitoring claims, we must first determine whether the district court's decisions to exclude some of the plaintiffs' evidence was proper. We then discuss whether, given the admissible evidence, the plaintiffs satisfied their burden to avoid summary judgment on the medical monitoring cause of action we outlined above.

1. Admissibility of plaintiffs' evidence

a. Dr. Sherman's Testimony

The district court excluded Dr. Sherman's testimony regarding medical monitoring along with the rest of her testimony. The district court held that because Dr. Sherman testified that she did not know what the terms "specificity" or "sensitivity" of a medical test referred to, her methodology in ordering medical monitoring tests was unreliable. Defendants' expert Dr. Roediger explained the meaning of the terms specificity and sensitivity. He stated that if a medical test were designed to ascertain whether a person had a particular illness, a more specific test would produce an affirmative result only when it was quite certain that the person had the illness; while a more "sensitive" test would produce an affirmative result even if there was only a remote chance that the person had the illness.

Dr. Roediger also testified that "it is a necessity to understand the concept because as this antibody assay laboratory material was referred to, one has to be aware of sensitivity and specificity in order to place any relationship to the relevance of that to the case." He also testified that one could not do original research without understanding these concepts. Dr. Weitekamp added that, "I don't think you can apply a test to clinical practice, unless you have an understanding of sensitivity and specific-

ity." Based on this testimony, the district court excluded Dr. Sherman's testimony and, because only Dr. Sherman proposed a particular medical monitoring program for the Kohn/Klehr plaintiffs, granted summary judgment against these plaintiffs on their medical monitoring claims.

Although the district court's holding is facially based on methodology, its rationale seems to be based more on Dr. Sherman's expertise, i.e., the court seems to be holding that no one who fails to understand the concepts of sensitivity and specificity is qualified to testify as to what diagnostic techniques are appropriate for a particular patient. While a court can appropriately take into account an expert's degree of expertise in conducting its *Daubert* analysis, *see supra* at 40-43, it cannot exclude the expert's opinion based solely on a supposed lack of expertise when the expert meets the qualifications of Rule 702. The danger in what the district court has done here is that it has circumvented Rule 702's liberal standards of qualifications for experts by a strict reading of the requirement of a reliable methodology.

We have already held that Dr. Sherman is qualified to give expert testimony as an internist—an expertise that inherently involves decisions as to what diagnostic techniques are appropriate. We do not think that her inability to identify the meaning of two technical terms eradicates that expertise—especially where there was no exploration of the question whether Dr. Sherman's failure to recognize the two terms also demonstrated a failure to understand the substantive concepts those terms represented. Moreover, Dr. Roediger's testimony that an understanding of these terms was important took place in the context of his analysis of Dr. Sherman's ability to interpret the immunological tests—not in the context of analyzing Dr. Sherman's ability to determine what tests should be performed generally (such as for medical monitoring). And Dr. Weitekamp's testimony that one cannot "apply a test to clinical practice," absent an understanding of these terms,

seems only to mean that one cannot interpret certain tests without understanding these terms—it does not seem to mean that one cannot know what tests are appropriate without understanding the terms.

It may be true that failure to analyze the specificity or sensitivity of a particular test sometimes constitutes a methodological flaw that renders a doctor's opinion that that test is a useful diagnostic technique unreliable and hence inadmissible. But the defendants fail to point to evidence in the record suggesting that an analysis of specificity and sensitivity is necessary for the diagnostic tests Dr. Sherman prescribed for these plaintiffs to undergo, or to evidence that Dr. Sherman failed to analyze specificity and sensitivity in substance, although she did not understand the particular terms.

There may be other flaws in Dr. Sherman's methodology for concluding that particular tests are needed which, when considered in light of Dr. Sherman's limited expertise, render her opinion as to the need for a particular test inadmissible. It may be that in order reliably to evaluate the need for a particular type of test, one has to read the medical literature on the value of that test. Dr. Sherman did not always read such literature. For example, she suggested that plaintiffs should have a dental exam to check for any malignancies in the mouth or throat—especially lymphomas, but her view that dental exams were effective in detecting lymphomas was based on one friend of hers whose lymphoma had been detected in such an exam, and her view that early detection could help cure lymphoma was based on her diagnosis of 10-50 patients, none of whom she treated herself.[54]

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[54] Other potential problems existed as well. Dr. Sherman stated that the plaintiffs should undergo a chromosomal analysis to look for evidence of leukemia but admitted that she had not made any evaluation of the predictive value of such an analysis, although she stated that there was some literature advocating such a use of the tests. (JA 843-44). She recommended performance of an

Yet defendants do not make these arguments; nor do they point to any evidence that a doctor cannot reliably evaluate the worth of particular medical tests based on anecdotal evidence gathered over a lifetime of involvement in the medical profession; nor did the district court base its decision on this basis. Thus, we hold that the district court abused its discretion in relying purely on Dr. Sherman's failure to understand certain terms in excluding her testimony on medical monitoring as unreliable.

b. Dr. DiGregorio's testimony.

i. Reliability

Dr. DiGregorio testified that, as a result of their exposure to PCBs, the Hanes plaintiffs had a greater risk of contracting future illnesses than average members of the population. He stated that this would be true of anyone exposed to even one molecule of PCBs, and that, as a result, plaintiffs should undergo medical monitoring.

The court excluded Dr. DiGregorio's testimony under Rule 702 finding that his methodology was "non-existent, and therefore completely unreliable." In the court's view, Dr. DiGregorio's statement that he needed to examine plaintiffs before he could render a final opinion as to the cause of their present illnesses, combined with his reliance on plaintiffs' statements for evidence of their PCB exposure rather than conducting independent tests of the amount and source of plaintiffs' PCB exposure, made his conclusion that they needed medical monitoring unhelpful in showing "to a reasonable degree of medical certainty": (1) that medical monitoring is "necessary in order to diagnose properly the warning signs of disease," (2) that plaintiffs were significantly exposed to a hazardous substance, or (3) that the exposure came from the

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alpha globulin test although she did not know how such a test was performed today and had not performed such a test since 1968 or 1969.

railyard, quoting *Paoli I* 916 F.2d at 851 (quoting *Askey v. Occidental Chemical Corp.*, 477 N.Y.S.2d 242, 247 (1984) (internal quotation marks omitted)). The district court also noted that Dr. DiGregorio was unable to state an opinion on whether any plaintiffs would develop future injuries, and could not quantify the increased risk they faced.[55]

Plaintiffs respond that Dr. DiGregorio did not need to examine the patients to determine that they were exposed to significant *future* risk of developing disease. Plaintiffs cite the "Proposed Plan Paoli Railyard Superfund Site" authored by the EPA in March of 1992 which found extensive PCBs in residential soil and an "incremental cancer risk for children and adults in the residential area near the Rail Yard with lifetime exposure to residential soils . . . in the range of 1×10^{-4} to 1×10^{-5}." Plaintiffs note that they lived for many years directly adjacent to the railyard and were significantly exposed to soil from their yards and the railyard. Given such a risk, they contend, Dr. DiGregorio employed perfectly acceptable methodology in concluding that "medical monitoring is, to a reasonable degree of medical certainty, necessary in order to diagnose properly the warning signs of disease." The fact that Dr. DiGregorio would not say with a reasonable degree of medical certainty that plaintiffs *would* become ill in the future and would not quantify plaintiffs' increased risk is, in their view, irrelevant. He was willing to say with a reasonable degree of medical certainty that they needed medical monitoring.

We agree with plaintiffs that Dr. DiGregorio could reliably testify as to a patient's future risks without ex-

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[55] In addition to his testimony about present illnesses and medical monitoring, Dr. DiGregorio also testified to some general evidence that PCB caused harm in humans and in animals (JA 2634-35, JA 2655) and for the reasons about his confidence in extrapolating from animal studies for PCBs (JA 2655). It is not clear on what basis the district court excluded this testimony and it appears to be admissible.

amining the patients. None of the defendants' experts stated that physicial examinations were necessary in order to reliably predict future risks; they were all testifying about the methodology necessary in order to evaluate present illnesses. We also agree that a doctor does not have to testify that a plaintiff will become ill in the future in order to justify medical monitoring. Finally, we agree with the plaintiffs that Dr. DiGregorio had sufficient data to conclude reliably that the plaintiffs had been significantly exposed to PCBs. In 1988, Dr. DiGregorio reported that he based his assessment of exposure on a residential history of each plaintiff, and on fat and blood tests of the various plaintiffs which he had performed.[56] Defendants did not present any evidence that these types of data are unreliable or that it is an unreliable methodology to use this data to assess exposure for the purpose of determining the need for medical monitoring.

ii. Failure to Comply With the Scheduling Order

In addition to testifying that the Hanes plaintiff should receive medical monitoring, Dr. DiGregorio submitted a medical monitoring program that he thought the plaintiffs should undergo. The district court precluded him from testifying regarding this program because he was late in producing it. The plaintiffs challenge this ruling.

On June 4, 1991 the court ordered plaintiffs to file their Rule 26(b)(4) statements detailing the substance of their experts' testimony by March 17, 1992. *See supra* pp. 36-37. However, as of Dr. DiGregorio's April 16, 1992 deposition, in which he asserted that the plaintiffs should be subject to a medical monitoring program, the plaintiffs

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[56] While in his 1992 deposition, Dr. DiGregorio testified that it may well have been that his source of evidence of plaintiffs' exposure was their own testimony, he also stated he had not reviewed his records and that he had previously stated his source (in 1988). The 1988 statement is part of this record.

had not submitted any medical monitoring program prepared by Dr. DiGregorio to the court. In fact, at the time of his deposition, Dr. DiGregorio had still not developed such a program and did not do so until two days later (April 18). As a result, the district court excluded Dr. DiGregorio's opinion about medical monitoring. As the district court explained, it had the authority under Rule 37(b)(2)(B) of the Federal Rules of Civil Procedure to sanction a party's failure to comply with a discovery order by "prohibiting that party from introducing designated matters in evidence." Fed. R. Civ. Pro. 37(b). "The trial court's exclusion of testimony because of the failure of counsel to adhere to a pretrial order will not be disturbed on appeal absent a clear abuse of discretion." *Semper v. Santos*, 845 F.2d 1233, 1237 (3d Cir. 1988). In evaluating whether the district court properly exercised its discretion, we consider:

> (1) the prejudice or surprise in fact of the party against whom the excluded witnesses would have testified, (2) the ability of that party to cure the prejudice, (3) the extent to which waiver of the rule against calling unlisted witnesses would disrupt the orderly and efficient trial of the case or of other cases in the court, and (4) bad faith or willfulness in failing to comply with the district court's order.

Meyers v. Pennypack Woods Home Ownership Ass'n, 559 F.2d 894 (3d Cir. 1977). "[T]he exclusion of critical evidence is an 'extreme' sanction, not normally to be imposed absent a showing of willful deception or 'flagrant disregard' of a court order by the proponent of the evidence." *Id.* at 905 (quoting *Dudley v. South Jersey Metal, Inc.*, 555 F.2d 96, 99) (3d Cir. 1977).

Applying the *Pennypack* factors, the district court found that, although the plaintiffs' had identified Dr. DiGregorio as a witness by the March 17 deadline and although Dr. DiGregorio had previously testified that plaintiffs needed a medical monitoring program, the plaintiffs' failure to

identify the substance of that program by the deadline prejudiced the defendants. Development of the specifics of the program on April 18 left the defendants only 60 days before the deadline the court had set for deposition of experts to depose Dr. DiGregorio about the program and to find new experts to examine the plaintiffs and come up with their own proposal for monitoring. Most important, the court's finding that plaintiffs' delay in submitting a medical monitoring program was due to bad faith and willfulness, and that was because the plaintiffs had failed to complete in nine and a half months a task that turned out only to take two days.

We have great difficulty with the district court's rulings. The prejudice to the defendants here is extremely minimal. Plaintiffs properly identified Dr. DiGregorio as a witness by the March 17 deadline, thus the defendants knew that he was going to testify. They were also aware of the general substance of his testimony and even some of the specifics of his plan for medical monitoring. In his April 4, 1988, deposition, Dr. DiGregorio stated that he would:

> do a base line Physical and history . . . . I would include a serum PCB level, a possible fat biopsy for PCB's. And then depending on the results and what type of information we get back from them, I would make my evaluation at that point. That would be my baseline program.

Moreover, defendants were provided with all of the specifics of Dr. DiGregorio's proposed medical monitoring plan on April 18, only a month after the district court's deadline, four months before the schedule trial date, and 60 days before the deadline the district court had set for ending discovery. Thus, the defendants had abundant time to depose Dr. DiGregorio regarding the specifics of his proposed program before the discovery deadline, and the district court could easily have extended the deadline to provide the defendants even more time. As a result, under the first three *Pennypack* factors—1) prejudice to the

defendant 2) ability to cure the prejudice and 3) degree of disruption of an orderly trial or of other cases, there is little in favor of exclusion.

Although we have generally upheld trial courts' imposition of sanctions excluding witnesses because of the district court's need for broad leeway to manage its cases, *see, e.g., United States v. 68.94 Acres of Land*, 618 F.2d 389, 396-97 (3d Cir. 1990); *Semper v. Santos*, 845 F.2d 1233, 1237-38 (3d Cir. 1988), *Coleco Industries Inc. v. Berman*, 567 F.2d 569-70 & n. 14 (3d Cir. 1977), we have reversed an exclusion where, as is the case here, there was only a slight deviation from pre-trial notice requirements, and admitting the witness was likely to cause only slight prejudice to the defendants, who were already aware of the basic substance of the witness' testimony. *See De Marines v. KLM Royal Dutch Airlines*, 580 F.2d 1193, 1202 (3d Cir. 1978). In fact, admission of the testimony in *KLM* was far more likely to cause prejudice than it was here, because the defendant in that case did not make the plaintiffs aware of the exact substance of the testimony until *trial*. Similarly, in *Pennypack*, we reversed the district court's exclusion of expert testimony despite the fact that the substance of the testimony was revealed far closer to trial than it was here (three weeks before trial), and where there was the possibility of some disruption of the trial or of other cases through the need to give the defendant an opportunity to depose the new witnesses. *See Pennypack*, 559 F.2d at 905.

The main possible justification for the district court's decision is that, unlike the courts in *KLM and Pennypack*, the district court made an explicit finding that the plaintiffs' failure to provide the specifics of Dr. DiGregorio's medical monitoring program was a result of bad faith. The court found:

> Plaintiffs were given nine and one-half months to develop a monitoring program. The Plaintiffs' attorneys merely had to ask Dr. DiGregorio to proceed

> with the development of this program, and it is shown that two days later a completed program would be in their hands. . . . Their lack of diligence in this matter constitutes a willful failure to comply with the Court's order.

But the district court's finding of willfulness and bad faith is clearly erroneous. Where plaintiffs named Dr. DiGregorio by the deadline, provided most of the substance of his testimony by the deadline, provided the additional substance shortly after the deadline when requested to do so, and had little to gain from the month delay in provision of the additional material, there is no basis on which to conclude that the plaintiffs deliberately failed to comply with the requirements of the district court order. "Lack of diligence" does not constitute bad faith.

Thus, in excluding Dr. DiGregorio's specific proposals for medical monitoring, the district court abused its discretion. As in *Pennypack*, the district court could have imposed a lesser sanction such as providing the defendants with the opportunity to re-depose Dr. DiGregorio and taxing the costs to the plaintiffs. *See Pennypack*, 559 F.2d at 905.

c. Dr. Schecter's testimony

Dr. Arnold Schecter, M.D., testified regarding laboratory blood tests and fat samples showing PCB levels above background for each plaintiff. However, the Hanes plaintiffs specifically told the district court that Dr. Schecter was not going to testify as to exposure or increased risk, but only that the plaintiffs increased fear of disease was reasonable. Thus, the court did not consider Dr. Schecter's testimony in analyzing plaintiffs' medical monitoring evidence on summary judgment. We hold that the district court was perfectly justified in determining that Dr. Schecter's testimony was not relevant for summary judgment purposes on any of plaintiffs' claims because plaintiffs' claims based on fear of disease are not cognizable under Pennsylvania law, *see supra* 128 & n. 51, and this was the only issue on which Dr. Schecter was supposed

to testify. We turn now to whether the plaintiffs have enough admissible evidence to avoid summary judgment on medical monitoring.

2. Summary judgment on medical monitoring

Five of the Kohn/Klehr plaintiffs (Bessie Cunningham, Matthew Cunningham, Amber Burrell, Priscilla Burrell and Patricia Ingram) presented the testimony of Dr. Nisbet to prove their significant exposure to PCBs. They, along with the rest of the Kohn/Klehr plaintiffs, also relied on soil samples in their yards showing PCB levels to be significantly above those deemed acceptable by the EPA. For example, levels in the Burrell's yard were measured in 1986 as high as 21 ppm, in Monica Hilton's yard as high as 21 ppm, in the Cunningham's yard as high as 7,000 ppm with 10 of 14 samples more than 60 ppm.[57]

The Hanes plaintiffs intended to rely partly on their own testimony as evidence of exposure—they planned to testify that they played in the Yard, that they lived near the Yard, and engaged in many activities on the soil in their yards. They did not point to any evidence documenting the levels of PCBs in their soil, but did point to EPA's general conclusion in its "Proposed Plan Paoli Railyard Superfund Site," which states that the Yard and nearby residential soils and streams were contaminated with PCBs. Moreover, Dr. DiGregorio testified regarding

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[57] In their supplemental submission, plaintiffs did not cite evidence regarding the soil level of PCBs at the homes of those plaintiffs who sought medical monitoring damages but did not seek damages for present injuries. These plaintiffs were Theresa Butler, William Butler, Marvin Simpson, Donald Simpson, Karen Simpson, Alan Simpson and Brian Jackson. Moreover, the levels of PCBs in the soil of Mabel Brown were 1.6 ppm—within the range EPA deems acceptable. But the defendants did not point to an absence of evidence of PCBs in the soil as a reason to grant summary judgment with respect to any of these plaintiffs, and thus, plaintiffs were under no obligation to point to it in response to the summary judgment motion or to place such evidence in the appellate record.

laboratory blood tests and fat samples showing PCB levels for each plaintiff, levels he thought were quite significant. We note that this evidence acquires added significance in light of Dr. Nisbet's admissible testimony that background levels are much lower than defendants contend.

All plaintiffs presented evidence that their exposure was significant enough to cause them a significantly increased risk of contracting disease. In EPA's Risk Assessment for the Paoli PCB Superfund site, it concluded that PCB levels in residential soils must be reduced to two parts per million to reduce cancer risks to acceptable levels (EPA has set acceptable risk at 1 in 100,000, although EPA's point of departure for risk assessments is 1 in 1,000,000). As was mentioned above, EPA's March 1992 "Proposed Plan Paoli Railyard Superfund Site" concludes that there are presently extensive PCBs in residential soils in Paoli which create an "incremental cancer risk for children and adults in the residential area near the Rail Yard with lifetime exposure to residential soils . . . in the range of 1×10^{-4} to 1×10^{-5}. Some plaintiffs presented additional evidence that they were subject to a significant risk of future serious disease. Dr. Nisbet testified that Priscilla Burrell had been exposed to sufficient levels of PCBs to cause adverse health effects, and that the Cunninghams had been "sufficiently exposed to PCBs to give rise to the expectation that they would suffer adverse health effects." With respect to Matthew Cunningham this was based on the fact that he had burned firewood and leaves from his yard and breathed the fumes and had eaten vegetables from his yard. Dr. Nisbet concluded that Amber Burrell's exposure was sufficient to cause serious health conditions, and that Patricia Ingram's exposure was sufficient to expect an effect on her immune system.

The fact that the risks to individuals in the Paoli area were high enough to warrant cleanup action by the EPA does not necessarily mean that they were high enough to

warrant medical monitoring.[58] But plaintiffs presented evidence that the risks from PCB exposure were significant enough to justify the costs of medical monitoring. Dr. Sherman testified that all of the plaintiffs should receive medical monitoring. She stated that anyone who lived near a toxic dump site, even if they had PCBs in their blood at levels as low as one part per billion, and even if they lived three blocks away from the site, should receive medical monitoring. Because all of the plaintiffs, including the Hanes plaintiffs, live near a toxic dump site, Dr. Sherman's testimony applies to them as well. Similarly, Dr. DiGregorio testified that all of the plaintiffs were at:

> risk because of their exposure to PCBs, some of which will be sensitive enough to be involved with one molecule . . . . So, a good physician or good scientist will set up a medical monitoring program to look at that. That's what the basis for a medical monitoring program is, to look for those people that are sensitive.[59]

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[58] Conversely, medical monitoring may sometimes be justified even though EPA concludes that remaining risks are acceptable given the costs of cleanup.

[59] Dr. DiGregorio's testimony that exposure to one molecule of PCBs warrants medical monitoring might imply that everyone should recieve medical monitoring because everyone in the population has probably been exposed to one molecule through backbround levels of PCBs. But this approach would not allow a reasonable jury to conclude that plaintiffs should receive such monitoring as a result of exposure to *defendants'* PCBs. Moreover, a conclusion that everyone who has been exposed to even one molecule of PCBs should receive medical monitoring evidences giving little consideration to the cost of the monitoring. Similarly, Dr. Sherman's testimony that everyone who lives near a toxic dump site should be subject to medical monitoring gives little evidence that she took into account the cost of medical monitoring. These aspects of plaintiffs' medical monitoring claims are somewhat underwhelming. But defendants did not ask Drs. Sherman and DiGregorio why they thought the risk to plaintiffs was high enough to justify the cost of medical monitoring; nor did they ask Dr. DiGregorio what made

This testimony also applies to each of the plaintiffs because they all had exposure to more than one molecule of PCBs.

The plaintiffs also presented evidence of diagnostic techniques that would make the "early detection and treatment of the disease[s] possible and beneficial." *Paoli I*, 916 F.2d at 852. Dr. Sherman prepared a sample protocol of diagnostic techniques she though would benefit plaintiffs. Dr. Sherman's protocol applies to the Hanes plaintiffs as well, because she thought that her protocol was applicable to everyone exposed to PCBs from the Paoli railyard. Moreover, Dr. DiGregorio presented a medical monitoring plan that we have held is admissible. *See supra* 142.

The opinions of Drs. DiGregorio and Sherman with respect to the medical monitoring issues pass *Daubert* muster. Moreover, on the present record, they survive summary judgment. Whether or not they will carry the day before a jury is quite another matter. Certainly the EPA risk assessement for the Paoli PCB Superfund Site is important and will be of aid to plaintiffs. On the other hand, the jury may or may not find the opinions of Drs. Sherman and DiGregorio sufficient to meet the *Paoli I* standard (with the Utah gloss thereon), *see supra* pp. 129-134. For now, we simply note that, given the admissibility of the DiGregorio and Sherman opinions on medical monitoring, which were not seriously challenged during the *in limine* hearing, the medical monitoring claims do survive summary judgment.

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him conclude that it was exposure to defendants' PCBs that justified medical monitoring. Thus, defendants failed to point to anything in the record that would prevent the issue of medical monitoring from going to a jury. The opinions of Drs. Sherman and DiGregorio thus created a genuine issue of material fact as to whether defendants' PCBs created a risk to plaintiffs significant enough to justify the cost of medical monitoring.

XII. PROPERTY DAMAGE

In addition to suing for personal injuries and medical monitoring, nine plaintiffs [60] sued for the diminution in property value of their homes caused by the proximity of the Yard and the presence of PCBs on their land. The district court granted summary judgment for the defendants on this claim.

The district court found that the EPA already has a plan under which it can and will remove the alleged contamination to plaintiffs' property. The court found that the plaintiffs had not submitted any evidence to indicate that EPA's remedy would not be effectuated or would be inadequate with regard to real property or groundwater contamination. The court concluded that absent *permanent* physical damage, plaintiffs had no claim. Any decrease in market value caused by the stigma associated with living near the railyard was not, in its view, compensable under Pennsylvania law. The court held that harm to the property (repair costs) rather than diminution of value is the proper measure of damages where the harm is temporary and remediable (citing *Kirkbride v. Lisbon Contractors*, 560 A.2d 809, 812 (Pa. Super. (1989)); and *Rabe v. Shoenberger Coal Co.*, 62 A. 854 (Pa. 1906)). The court stated that only if the damages are permanent is the proper measure of damages the diminution in value (citing *Ridgeway Court, Inc. v. Landon Courts, Inc.*, 442 A.2d 246, 248 (Pa. Super. 1981), and that Pennsylvania law presumes that damage is temporary and remediable and justifies a finding to the contrary only if the harm is "unequivocally beyond repair." (citing *Kirkbride*, 560 A.2d at 812-13). Here, according to the district court, the damage to the property was repairable.

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[60] Mabel Brown, K. Louise Jones, James Lament, Christopher Brown, Margherita Barbetta, Mary Retta Johnson, John Ingram, William Butler, and Matthew Cunningham.

Plaintiffs respond that even under the rule cited by the district court, the proper measure of damages is diminution in market value because there was in fact permanent damage to plaintiffs' property. First, EPA itself estimates that its cleanup will lower cancer risk only to 1 in 100,000, which is ten times higher than its normal remedial goal of lowering risk to 1 in 1,000,000. Second, Dr. Kopstein indicated that the EPA plan will not be effective in eliminating groundwater contamination, exposure through the air, and the continuing release of sediments from the Yard.

However, the district court found that Dr. Kopstein did not assert that a human health hazard would remain. He only stated that he could not calculate the levels of exposure levels from groundwater, air and sediment runoffs that would remain after the cleanup. The court added that Dr. Kopstein's testimony had only been offered for the purpose of establishing plaintiffs' "opportunities for exposure" to PCBs and thus could not establish a continuing health hazard. It noted that EPA's reduction of PCB levels to 2 ppm ensures that these levels are less than those the FDA allows in food packaging material, poultry and animal feed. *See* 21 C.F.R. § 109.30.

Despite Pennsylvania's presumption that damage is not permanent, we think the district court's decision to grant summary judgment was incorrect. As we see it, the EPA's own normal practice of cleaning up property to the point where the risk is 1 in 1,000,000 creates a genuine issue of material fact as to whether a cancer risk of 1 in 100,000 constitutes permanent damage; the tension with the FDA standards is for the jury to resolve. Moreover, the clear import of Dr. Kopstein's testimony, giving every inference to the nonmoving party, is that a human health hazard will remain after the EPA cleanup. In testifying to "opportunities for exposure," Dr. Kopstein could certainly testify that exposure on plaintiffs' properties was likely to continue to be high.

Plaintiffs also presented evidence to demonstrate permanent damage in a second way. While the requirement of permanent damage *to property* seems on its face to require permanent physical damage, plaintiffs convincingly argue that the stigma associated with the prior presence of PCBs on their land constitutes permanent, irremediable damage to property under Pennsylvania case law such that they can recover for the diminution of value of their land. They cite *Willsey v. Kansas City Power & Light Co.*, 631 P.2d 268, 273-75 (Kan. App. 1981), which states that in eleven of twenty six jurisdictions to consider the issue, loss of market value is recoverable when the government takes part of an owner's property and places electric power lines on it even if the market's fear of the power lines is unreasonable, *see e.g., United States ex rel Tennessee Valley Authority v. Easement and Right of Way*, 405 F.2d 305, 309 (6th Cir. 1968) ("[I]n final analysis, we are only concerned with market value. Although these studies may show objectively the complete safety of these structures, we are not convinced that certain segments of the buying public may not remain apprehensive of these high voltage lines"), and that in another nine jurisdictions, the rule is that diminution of market value is compensable so long as it has some reasonable basis, *see, e.g., Kentucky Hydro Electric Co. v. Woodard*, 287 S.W. 985 (Ky. 1926) ("If he cannot sell his property at as good a figure with this line on it as he could without it by reason of reasonable fears, not speculative but founded on experience and entertained by those who wish to buy, has he not been damaged in this regard?").

Plaintiffs submit that Pennsylvania has essentially adopted one of these two positions and that it applies to tort cases as well as takings cases. In *Appeal of Giesler*, 622 A.2d 408, 411-12 (Pa. Commw. 1993), decided after the district court decision in this case, the court held in a takings case that just compensation for land taken by the government to run an electric power line included full diminution of market value of the remaining land. The court quoted *United States v. Easement and Right-to-Way*,

249 F.Supp. 747, 750 (W.D. Ky. 1965) which held that, "[a]pprehension of injuries to person or property by the presence of power lines on the property may be taken into consideration insofar as the line affects the market value of the land. In the opinion of the Court, the apprehension of such danger constitutes an element of damage." 622 A.2d at 411-12. The court made this determination even though evidence on the health effects of electric lines was speculative.

Wade v. S.J. Groves & Sons Co., 424 A.2d 902, 912 (Pa. Super. 1981), also supports the proposition that a reduction in market value is recoverable even absent permanent physical damage to the plaintiffs' property. *Wade* involved the negligent modification by plaintiff's neighbor of a natural gully on that neighbor's land which changed the drainage patterns on that land and caused flooding on plaintiffs' land. The damage was repairable and the Wades were able to reduce to negligible levels any significant risk of future damage by undertaking a variety of flood control measures. *See id.* at 911. Nonetheless, there was a permanent change in the flood plain of the neighbor's land, a slight ongoing risk of renewed flooding, and a significant diminution in the value of the Wades' land. Despite the fact that the actual permanent change was to the neighbor's land, the court allowed compensation for the diminution in market value to the plaintiff's property that would remain after repairs were made. *See id.* at 911-12.

Defendants assert that *Wade* and *Giesler* do not support plaintiffs' proposition, and that plaintiffs' citation to the law of other jurisdictions is irrelevant and contradicted by the law of other jurisdictions. *See, e.g., Adams v. Star Enterprise*, 1994 WL 172266 at * 3 (E.D. Va. 1994) (holding that stigma damages based on unfounded fear about dangers in the vicinity of property are unavailable in a nuisance action). Defendants submit that the presence of the electric lines in *Giesler* and the change in the flood plain in *Wade* were permanent

whereas the PCBs here are, presumably, not present permanently. However, the permanent physical changes in *Wade* and *Giesler* were to neighboring land; there was no permanent physical change to plaintiffs' land. Defendants respond that the changes to neighboring land posed a continuing risk of damage to plaintiffs' land. But it is not clear why this continuing risk constitutes permanent physical damage to any greater extent than the continuing stigma of living on property which once contained significant amounts of PCBs.

Moreover, defendants are incorrect that the changes to neighboring land in *Giesler* posed a continuing risk to plaintiffs' land. The *Giesler* court assumed that the electric lines caused no actual physical risk of any sort to plaintiffs' land. This means that the only ongoing damage to the property in *Giesler* was the diminution in value caused by the stigma of living near electric lines which is comparable to the stigma of living on property which once contained significant quantities of PCBs.[61] And, in any case, there is *some* ongoing risk to plaintiffs here based on the admittedly small quantities of PCBs left on the land.[62]

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[61] It is possible to argue that the *taking* of property to install the electric lines in *Giesler* was permanent—thus, there *was* a permanent change to some of the Gieslers' land. However, the Gieslers could have been fully compensated for the permanent loss of *this* land without being compensated for the diminution in value of their remaining land—land which was not physically damaged. Moreover, in *Wade*, there was no taking of plaintiffs' land nor any permanent damage to plaintiffs' land.

[62] Defendants also attempt to distinguish *Giesler* on the basis that it was a takings case not a tort case. However, *In re Larsen*, 616 A.2d 529 (Pa. 1992), *cert. denied*, 114 S. Ct. 65 (1993), held that compensation in a tort case is generally at least as great as in a takings case. In a tort case, unlike a takings case, the goal is to compensate the plaintiff "for all injuries proximately caused by the defendant's action" including property lost and incidental injuries not recognized in eminent domain actions. *See Larsen*, 616 A.2d at 599-600. Indeed, *Wade* was a tort case.

Even if the facts of *Wade* and *Giesler* are somewhat distinguishable from the facts here, the principles articulated in *Wade* essentially eliminate the possibility that an injury to land must be physical for it to be considered permanent. After citing the traditional Pennsylvania rule that diminution in market value is only recoverable if damage is permanent, the court stated that the term permanent injury was meant to apply whenever repair costs would, for some reason, be an inappropriate measure of damages. *See Wade,* 424 A.2d at 912. And an appropriate measure of damages is generally defined as what is necessary to compensate fully the plaintiff. *See id.* at 911-12.

This approach is normally consistent with the view that, when physical damage is temporary, only repair costs are recoverable, because in a perfectly functioning market, fully repaired property will return to its former value. Thus, an award of repair costs will be fully compensatory. And it makes sense to award repair costs rather than the equivalent diminution of value absent repair, because it is easier to measure repair costs. Hence, normally, it is only when property cannot be repaired that courts must award damages for diminution of value in order to fully compensate plaintiffs. However, the market sometimes fails and repair costs are not fully compensatory. In such cases, according to the principles of the *Wade* court, plaintiffs should be compensated for their remaining loss. Absent such an approach, plaintiffs are permanently deprived of significant value without any compensation. *See id.*

Although post-*Wade* cases, including Pennsylvania Supreme Court cases, continue to cite the traditional Pennsylvania rule without discussing *Wade*'s interpretation of that rule, *see, e.g., Kirkbride,* 560 A.2d at 813 (holding that "where an injury is reparable, the damage is the cost of repair or restoration") (citing *Lobozzo v. Adam Eidemiller, Inc.*, 263 A.2d 432 (1970)), none have rejected

Wade's interpertation of that rule.[63] We hope that the Pennsylvania courts will provide further guidance on this issue. For now, although *Wade* and *Giesler* are not decisions of the Pennsylvania Supreme Court, they are well reasoned decisions, and we think that at least where (1) defendants have caused some (temporary), physical damage to plaintiffs' property; (2) plaintiffs demonstrate that repair of this damage will not restore the value of the property to its prior level; and (3) plaintiffs show that there is some ongoing risk to their land, plaintiffs can make out a claim for diminution of value of their property without showing permanent physical damage to the land.[64]

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[63] Defendants' citations to the contrary are inapposite. *Hughes v. Emerald Mines Corp.*, 450 A.2d 1, 8 (Pa. Super. 1982) reversed an award of loss-in-market-value damages for the pollution of the plaintiffs' wells because restoration of those wells was possible. But the plaintiffs did not present any evidence in that case that a diminution in market value would remain even after restoration of the wells.

[64] Defendants' amicus, the American Insurance Association, cites cases from several jurisdictions where plaintiffs who lived near contaminated sites or nuclear power plants were denied recovery for diminution in property value. In *Adkins v. Thomas Solvent Co.*, 487 N.W. 2d 715 (Mich. 1992), for example, the Michigan Supreme Court held that allowing recovery in such cases might permit recovery for "unfounded fears regarding persons with AIDS moving into a neighborhood, the establishment of otherwise lawful group homes for the disabled, or unrelated persons living together, merely because the fears experienced by third parties would cause a decline in property values." *Id.* at 726. The *amicus* also argues that allowing a tort for diminution in value would allow thousands of insubstantial and peripheral claims, would often grant recoveries for routine fluctuations in market prices thus generating windfalls, and would increase insurance costs, reduce the availability of insurance, and reduce the availability of funds to compensate those who were actually injured. *See* Abraham, *Environmental Liability and the Limits of Insurance*, 88 Colum. L. Rev. 942, 972-74 (1988).

We think that these concerns are overstated. The rule we have articulated only allows recovery when there has been some initial physical damage to plaintiffs' land. *Cf. Berry v. Armstrong Rubber Co.*, 989 F.2d 822 (5th Cir. 1993), *cert. denied*, 114 S. Ct. 1067 Subnom. *Cooper v. Armstrong Rubber Co.* 1994 (holding that

Thus, we will reverse the district court's grant of summary judgment on the plaintiffs' property damage claims.

XIII. CONCLUSION

As this opinion makes clear, the Supreme Court in *Daubert* has clarified that district courts have an important role to play in policing putative experts' contributions to the truth-seeking process at trial. We are quite confident that the district court bench is equal to that task. Of course, toxic tort cases, like this one, can become staggeringly expensive undertakings for all parties involved, and often require extensive involvement by experts. Thus, we also expect that trial courts, mindful of the Supreme Court's observation that the law must "resolve disputes finally and quickly," *Daubert,* 113 S.Ct. at 2798, will continue to seek innovative ways to fulfill their duties under *Daubert* while also seeking to conserve judicial resources, as well as those of the litigants.

For the foregoing reasons the district court's grant of summary judgment on Bessie Cunningham's claims that her exposure to defendants' PCBs caused her headaches, arthritis/arthralgia and hypertension will be reversed. We will also reverse the district court's grant of summary judgment on Amber Burrell's claims that her exposure to defendants' PCBs caused her respiratory ailments. Additionally, we will reverse the district court's grant of summary judgment on the medical monitoring claims and property damage claims of all plaintiffs asserting those

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Mississippi law only allows recovery for a decrease in property value caused by stigma where there has been some physical harm to the property). This rules out recovery in cases such as the establishment of a group home for the disabled; moreover, recovery in such cases might well be barred as against public policy. Any risk of an avalanche of litigation with every market fluctuation will be prevented by the need of plaintiffs to establish causation and to prove that the stigma associated with their land will remain in place after any physical damages to their land has been repaired.

claims (they are listed in the margin).[65] However, the district court's grant of summary judgment regarding all of the other plaintiffs' claims of present injuries, and all of the plaintiffs' claims of fear of future illness and of risk of illness will be affirmed.

ROTH, *Circuit Judge, concurring*

I join in the opinion of the court except that I cannot agree with all the guidelines established by the majority in reaching their conclusion. Specifically, contrary to the majority's holding in Part V.A.4 (at pages 43 through 49) [38a-44a], I do not believe that it is "helpful" for the jury to receive information which the trial judge concludes is not accurate. In my opinion, the "gatekeeper" function of the trial judge established by the Supreme Court in *Daubert* would not be fulfilled by permitting inaccurate information to go to the jury even though the trial judge may have determined that the methodology used to produce such results is reliable.

A True Copy:

Teste:

Clerk of the United States Court of Appeals
for the Third Circuit

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[65] The following plaintiffs have asserted property damage claims: Mabel Brown, K. Louise Jones, James Lament, Christopher Brown, Margherita Barbetta, Mary Retta Johnson, John Ingram, William Butler, and Matthew Cunningham.

All plaintiffs except James Lament appear to have asserted medical monitoring claims, but the medical monitoring claims of Matthew Cunningham, who is deceased, have been extinguished.

APPENDIX II

UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

No. 92-1995

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MABEL BROWN, Individually and on behalf of all others similarly situated

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); AND
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
ROY F. WESTON, INC.; and
OH MATERIALS COMPANY; and
GENERAL ELECTRIC COMPANY; and
THE BUDD COMPANY; and
WESTINGHOUSE ELECTRIC CORPORATION;
MONSANTO CO.;
PENN CENTRAL CORPORATION
Mabel Brown, Appellant

(D.C. Civ. No. 86-02229)

No. 92-1996

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

GEORGE ALBERT BURRELL and
PRISCILLA ETHERIDGE BURRELL,
in their own right, and GEORGE ALBERT BURRELL and
PRISCILLA ETHERIDGE BURRELL, as parents and natural
guardian of AMBER SHARDAI BURRELL, a minor, and
GEORGE ALBERT BURRELL, as parent and natural
guardian of ANDRE WALKER, a minor, and
PRISCILLA ETHERIDGE BURRELL, as parent and
natural guardian of BOBBY GEORGE ALBERT
CHRISTIAN BURRELL, a minor

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION
AUTHORITY ("SEPTA"); and
NATIONAL RAILROAD PASSENGER CORPORATION
("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
MONSANTO COMPANY;
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;

v.

PENN CENTRAL CORPORATION
George Burrell, Priscilla Burrell,
Amber Burrell and
Monica Hilton, Appellants

(D.C. Civ. No. 86-02235)

No. 92-1997

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

WALLACE DARRYL CUMMINS

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA"); AND
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); AND
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA; and
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
MONSANTO COMPANY
Wallace D. Cummins, Appellant

(D.C. Civ. No. 86-02669)

No. 92-1999

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

K. LOUISE JONES, ADMINISTRATRIX OF THE ESTATE OF HARVEY N. JONES, JR., DECEASED AND K. LOUISE JONES AS PERSONAL REPRESENTATIVE OF HARVEY N. JONES, JR., AND K. LOUISE JONES IN HER OWN RIGHT

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK");
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
MONSANTO COMPANY;
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY; AND
WESTINGHOUSE ELECTRIC CORPORATION;
K. Louise Jones and
Harvey Jones, Appellants

(D.C. Civ. No. 86-05277)

No. 92-2000

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

JAMES LAMENT, individually and on behalf of all others similarly situated

v.

SEPTA; AMTRAK and CONRAIL;

v.

PENN CENTRAL CORPORATION;
UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
MONSANTO CO.;
GENERAL ELECTRIC CO.;
BUDD CO., AND
WESTINGHOUSE ELECTRIC CORPORATION
James Lament, Appellant

(D.C. Civ. No. 86-05886)

No. 92-2010

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

JOHN INGRAM, SR., and
PATRICIA INGRAM, in their own right and as
parents and natural guardians of JOHN INGRAM, JR.; and
APRIL INGRAM in her own right

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION
AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION
("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL"); and
MONSANTO COMPANY ("MONSANTO"); and
GENERAL ELECTRIC COMPANY ("GE"); and
CITY OF PHILADELPHIA ("PHILADELPHIA")

v.

UNITED STATES OF AMERICA;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION
John Ingram, Sr. (and as representative of decedent, Patricia Ingram), John Ingram, Jr., Patricia Ingram and April Ingram Robinson-Ray, Appellants

(D.C. Civ. No. 86-07561)

No. 92-2011

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MARY ALICE KNIGHT,
Appellant

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL"); and
MONSANTO COMPANY ("MONSANTO"); and
GENERAL ELECTRIC COMPANY ("GE"); and
CITY OF PHILADELPHIA ("PHILADELPHIA")

v.

UNITED STATES OF AMERICA;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION

(D.C. Civ. No. 87-00712)

No. 92-2014

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

WILLIAM BUTLER; THERESA BUTLER;
MARVIN L. SIMPSON; ALLEN K. SIMPSON;
KAREN R. SIMPSON; DONALD E. SIMPSON; and
BRYAN M. JACKSON

v.

SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA");
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

UNITED STATES OF AMERICA;
CITY OF PHILADELPHIA;
MONSANTO COMPANY;
GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION
William Butler, Theresa Butler, Bryan Jackson, Allen Simpson, Donald Simpson, Karen Simpson and Marvin Simpson, Appellants

(D.C. Civ. No. 87-02874)

No. 92-2016

IN RE: PAOLI RAILROAD YARD PCB LITIGATION

MATTHEW CUNNINGHAM; AND
BESSIE CUNNINGHAM,
Appellants

v.

MONSANTO COMPANY; and
SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY ("SEPTA"); and
NATIONAL RAILROAD PASSENGER CORPORATION ("AMTRAK"); and
CONSOLIDATED RAIL CORPORATION ("CONRAIL")

v.

GENERAL ELECTRIC COMPANY;
THE BUDD COMPANY;
WESTINGHOUSE ELECTRIC CORPORATION;
PENN CENTRAL CORPORATION,
Third-Party Defendants

Present: BECKER, ROTH, and LEWIS, *Circuit Judges.*

SUR PETITION FOR PANEL REHEARING

The petition for rehearing filed by Appellants, having been submitted to the judges who participated in the decision of this court and no judge who concurred in the decision having asked for rehearing, the petition for panel rehearing is DENIED.

BY THE COURT:

/s/ Edward R. Becker
Circuit Judge

Dated: Oct. 14, 1994